The
Tropical Agriculturist
May, 1937

EDITORIAL

THE MAJOR AGRICULTURAL TRAGEDY OF INDIA

"IT is the lack of an intensive animal husbandry which is the Major Agricultural Tragedy of India." This sentence in the article on the nature of export agriculture which Dr. C. R. Fay contributed to the December number of the Ceylon Economic Journal arrests our immediate and sympathetic attention because the observation is no less applicable to Ceylon than it is to India. Probably the ratio of the cattle to the human population in this Island is as high as it is in any other old country of settled agriculture : it is probably higher. But there is no general use of farmyard manure in the country ; good beef is not available outside the stores of the importers of frozen meats ; the urban population depends largely on imported preserved milks while hardly any milk is consumed in the country districts ; hides command only a small price in the market because they are damaged by decorative branding ; even bone meal for manurial and other purposes has to be imported.

Dr. Fay attributes the paradox of an abundance of cattle and a scarcity of all forms of cattle produce of good quality in India to social and religious custom which forbids to the Hindu the consumption of meat, the killing of old and sickly animals and the regulation of breeding through the castration of bulls. Similar causes operate in Ceylon, but not to the same extent as in India. We too have religious scruples about killing, but the majority of us have no such scruples about the eating of meat which others kill, while we have no objection whatever to the castration of bulls ; and yet our standard of animal husbandry is lower than the low Indian standard. In recent years the

Agricultural Department has given considerable attention to the investigation of this phenomenon and to the search for remedies.

It is suggested that the system of communal pasture in the early days militated against the growth of the habits of good animal husbandry, as it must in any community in which the available land is not unlimited in relation to the population. Every cattle owner will try to secure for himself as large a share as possible of the common stock of cattle food, that is to say the grass in the village green. There was thus an active inducement to increase numbers. It was no one's business to regulate or restrict grazing, and over-grazing followed. In the dry zone this state of things persists up to this date. In the wet zone with the enclosure of practically all lands the people were faced with the alternatives of giving up cattle rearing or of adopting intensive methods of cattle farming. Two conditions that were necessary for the latter development were absent: knowledge of forms of cattle food which could be raised in substantial quantities by cultivation in small areas, and the existence of large centres of urbanized population which is ready to consume, and able to pay for, the produce of the farm and the dairy. In the circumstances cattle rearing gradually ceased to be a feature of village life in the wet zone.

Market conditions have improved slowly during the last 25 years by the growth of urban areas. But the question of cattle food still remains. It is on this aspect of the problem that the Agricultural Department is now concentrating—on this and on the efforts to recover by the introduction of new blood the ground lost by the progressive degeneracy of the breed. Varieties of fodder grass that thrive and yield an abundant supply of cattle food in both the wet and dry zones have been imported, and are being introduced in the villages, and large schemes are under consideration for the import and multiplication of proved herds of animals that are suitable to the conditions of this country. These are long-range trials and results will be distressingly slow in showing themselves. But animal husbandry cannot be rushed like the manufacture of inanimate articles, and the Department embarks on these schemes for revolutionizing the habits of a people not with rash optimism, but in steady faith and hope.

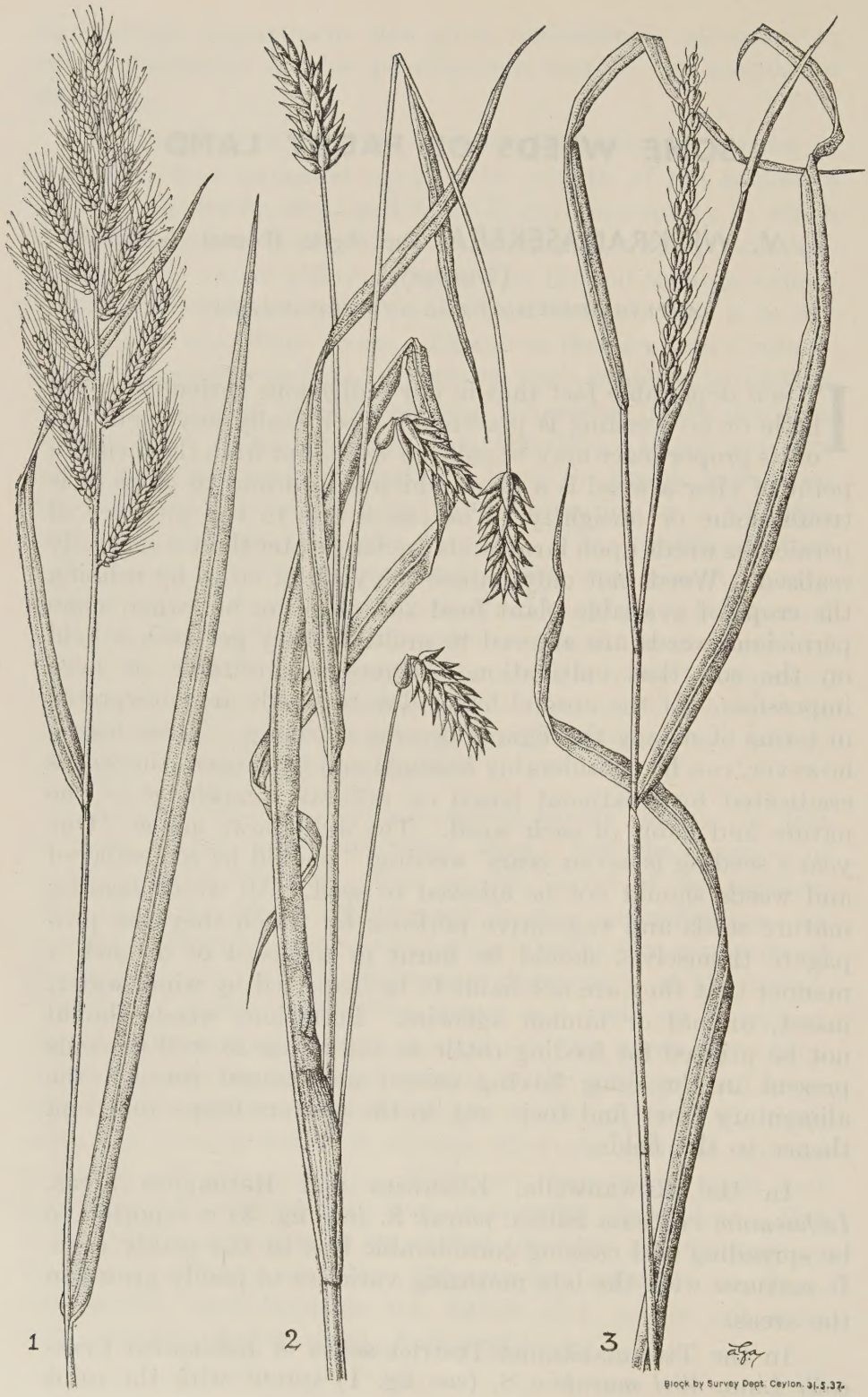
SOME WEEDS OF PADDY LAND

G. V. WICKRAMASEKERA, Dip. Agric. (Poona), A.I.C.T.A. (Trinidad),
ACTING AGRICULTURAL OFFICER (PADDY)

IT is a deplorable fact that in our indigenous agriculture very little or no weeding is practised. Technically any plant out of its proper place may be called a weed, but from the farmer's point of view a weed is a plant which is injurious to crops or is troublesome or unsightly. The losses due to the presence of pernicious weeds upon farm lands are far greater than is generally realised. Weeds not only reduce the yield of crops by robbing the crops of available plant food and moisture but when some pernicious weeds are allowed to multiply they get such a hold on the soil that cultivation becomes unprofitable or even impossible. If the annual losses due to weeds are interpreted in terms of money the figures become alarming. These losses, however, can be considerably lessened and by degrees the weeds eradicated by treatment based on accurate knowledge of the nature and habit of each weed. The well-known adage "One year's seeding is seven years' weeding" should be remembered and weeds should not be allowed to seed. All weeds bearing mature seeds and vegetative portions by which they can propagate themselves should be burnt or disposed of in such a manner that they are not liable to be dispersed by wind, water, insect, animal or human agencies. Pernicious weeds should not be utilised for feeding cattle as the refuse as well as seeds present in the dung having passed undamaged through the alimentary tract find their way to the manure heaps and from thence to the fields.

In the Ruwanwella, Kuruwita and Ratnapura areas, *Ischaemum rugosum* Salisb. *maruk* S. (see fig. 3) is reported to be spreading and causing considerable loss to the paddy crop. It matures with the late maturing varieties of paddy grown in the areas.

In the Tissamaharama District seeds of *Echinocloa Crus-galli* Linn. *Wel marukku* S. (see fig. 1) sprout with the rains



Some Weeds of Paddy Land

or when the fields are prepared for sowing paddy and the weed matures with the late maturing *suduheenati*, *sinnanayam* and *rathkariel* paddy crops. When fields, not sown with the late maturing varieties, are later in the season hastily prepared and the early maturing *murungan* or *danahala* paddies sown, the weed may shoot out from the stubble and mature along with these varieties of paddy.

In the Ambepussa, Gampaha and Uruwela areas, under the Giant's Tank in the Mannar District and in some parts of the North-Western Province, *Coix gigantea* Koen. *Kirindi* S. (see fig. 2) is spreading. This weed should not be confused with the edible adlay (*Coix Lachryma-Jobi*). The leaves of the former are narrower, the ear-heads pendulous, and the grain is pale brownish-grey, polished, broadly ovoid, and larger than the latter. It matures with the paddy crops of the normal period of maturity in the respective areas.

It is difficult to distinguish the foregoing weeds from paddy seedlings till they reach the flowering stage. It is, however, not advisable to uproot the weed in thickly infested fields, after flowers appear, as at that stage the paddy crop too is in flower and the mechanical damage to the latter would be very considerable. When only a few stray plants appear they should be uprooted and burnt before seeds set in the flowers.

The following methods are suggested for controlling these weeds :—

(*a*) Uproot and destroy the weed in sparsely infested fields soon after flowers appear.

(*b*) Seed paddy should be secured only from fields known to be free from the weeds.

(*c*) Heavily infested fields should be sown late with an early maturing variety of paddy for a season or two and preparatory tillage operations should be thorough in order to decompose all weeds which may have sprouted with the rains.

(*d*) A sure method of eradication which is worth trying, but which is difficult to induce the cultivators to adopt, is to leave the land unsown with paddy one season after it is ploughed so that the weed only will grow and can then be removed by hand, or, whenever conditions are suitable, to cultivate an economic crop like green gram or vegetables or even a green manure crop for one season and remove the weeds by hand.

(*e*) Bunds, irrigation channels, and surrounding areas should be searched and the weeds destroyed before seeds mature.

SOME STUDIES ON TOBACCO DISEASES IN CEYLON—II

FIELD SPRAYING AGAINST FROG-EYE *CERCOSPORA NICOTIANAE* E. & E.

MALCOLM PARK, A.R.C.S.,
MYCOLOGIST
AND
M. FERNANDO, Ph.D., B.Sc., D.I.C.,
RESEARCH PROBATIONER IN MYCOLOGY

IN the first part of this series of articles (1937), details were given of an experiment which demonstrated the efficacy of spraying tobacco seedlings in the nursery with colloidal copper in reducing the incidence of frog-eye infection on plants after transplanting into the field. Subsequent observations indicated that the protective effect of the fungicide was of limited duration in this instance. Leaves developing subsequent to transplanting were not sprayed and were therefore susceptible to the disease. Further, the sprayed leaves were removed at the first priming. The presence of unsprayed plants in the control blocks may have had a considerable bearing on the final extent of infection of the plants. It is not proposed to discuss here the ultimate effect of nursery spraying on the extent of frog-eye attack on tobacco in the field. It is obvious that the full value of such nursery spraying would be obtained only if large areas were planted up with sprayed nursery plants and, even then, the effect might well be cumulative and become more marked if the treatment were repeated in subsequent seasons. It is proposed to investigate this question further.

To revert, observations made about six weeks after transplanting indicated that frog-eye infection was present on every plant. The disease appeared to be of average severity, infection being considered to be neither exceptionally great nor

exceptionally light. No exact criteria of infection are available but it may be assumed that the extent of infection was fairly average.

In a high-class, flue-cured tobacco, the presence of numbers of frog-eye spots which appear before curing and of barn-spots which develop during curing and which have been shown to be due to infections by the same parasitic fungus, results in a considerable reduction in the value of the cured leaf. It was felt that, if the disease could be adequately controlled by one field spraying, such a spraying might be economically practicable and perhaps profitable.

The experiment described below was designed to determine the degree of control of frog-eye which could be obtained by a single spraying of plants in the field. The experiment was also framed to determine, within wide limits, the stage of growth of the tobacco at which such a spraying would give best results.

LAY-OUT OF THE EXPERIMENT

The lay-out took the form of five randomized blocks, each of four plots. Each plot consisted of four rows of 15 plants. Records were taken from the central 26 plants (2 rows of 13 plants) in each plot, the remaining 34 plants serving to overcome border effects. The experimental material consisted of a fairly uniform stand of plants of Harrison's Special tobacco grown at the Experiment Station, Wariyapola. These were derived from the nursery which was described in the first article of this series and were plants grown from seed surface-sterilized with silver nitrate solution, which had been sprayed in the nursery with colloidal copper. The area containing the plots was adjacent to the four-acre field on which were made the observations previously recorded.

The plants chosen for experiment were transplanted from the nursery during the period 14–16 November, 1936. The area was manured twice—once before and once after transplanting—with the following manure mixture :—

Superphosphate	..	224 lb.
Sulphate of potash	..	140 lb.
Nitrate of soda	..	184 lb.
		548 lb. per acre

The plants were primed for the first time on 28th December, 1936, and for the second time about a month later.

The plants were topped when the flowering shoot developed. At the time of the second spraying, on 26th January, 1937, about 30 per cent. of the plants had been topped, the remainder being topped soon after this date.

The following four treatments were randomized within each block :—

Treatment No.	*Treatment*
0	Unsprayed control
1	Sprayed with colloidal copper on 7-1-37
2	Sprayed with colloidal copper on 26-1-37
3	Sprayed with colloidal copper on 20-2-37

TECHNIQUE

Spraying.—Spraying was done with a pneumatic knapsack sprayer working at a pressure of 75 lb. per sq. in. The spray-lance was fitted with an angle-bend to facilitate the spraying of the lower surface of the leaves and the single nozzle was of the type which delivers a fine mist of spray.

The spray mixture used consisted of—

1 oz. ' Bouisol ' colloidal copper
1/16 oz. Agral 2
1 gallon water.

Bouisol is a proprietary fungicide consisting of a suspension of a basic copper derivative containing sulphite lye as the protective colloid. Agral 2 is a proprietary spreader having a composition allied to a sulphonate of an alkylated hydrocarbon. Six to eight gallons of the spray mixture were used at each spraying, which works out at about one gallon of spray to twenty plants. The plants were sprayed very thoroughly and it is probable that the amount of spray used was more than was necessary. It was certainly greater than the amount which would be used for the same number of plants in large-scale field spraying.

A noteworthy point is that no spray scorch was observed in the experimental plots at any time.

Harvesting.—The leaves from the experimental plots were harvested at the same time as those in the rest of the tobacco area. The usual practice adopted at Wariyapola is to harvest first all sand leaves. The leaves harvested in this first or preliminary harvest are not flue-cured but are air-cured and the resulting cured tobacco is of little value, being sold locally for chewing purposes. The main harvest which follows this includes all leaves which are mature and which are sufficiently clean to be worth flue-curing. Any leaves which are badly spotted are collected separately and air-cured. Leaves which are not sufficiently mature at the time of the main harvest are harvested later and flue-cured if sufficiently clean.

The time of the harvests may vary considerably from year to year with varying weather conditions. During the period of the experiment, the weather was relatively dry and, in consequence, the crop matured rather earlier than usual. The spraying programme, which had been laid down according to average conditions, was thereby not so well timed as it might have been. The first or preliminary harvest was made on 17th February, 1937, and the second or main harvest on 23rd February, 1937. It will be seen that the final spraying, which was done on 20th February, was carried out after the preliminary harvest and only three days before the main harvest. The intention was, when the experiment was planned, to carry out the final spraying ten days or so before the first harvest.

The early maturing of the tobacco was unfortunate in that, owing to a misunderstanding, the preliminary harvest was completed before a record of disease was made. It is considered, however, that this fact had no marked effect on the results obtained since all plants were of the same age and it will be shown later that the differences between the total numbers of leaves left after the preliminary harvest were not mathematically significant.

Recording of Results.—On the day before the second or main harvest, a count was made of the total number of leaves and of the number of "clean" leaves on each plant of the plots. The leaves examined at this time included many which were immature and which were not gathered with the main harvest. Leaves with 0 to 2 frog-eye lesions were classed as "clean" leaves.

On the following day, the leaves from each plot were harvested and flue-cured separately.

Following the usual practice, badly spotted leaves were not harvested for flue-curing, but were harvested separately and air-cured. The weights of the flue-cured leaf from the various plots were, in consequence, in themselves a measure of the relative freedom of the plants from frog-eye.

The harvested leaves from Block D were accidentally mixed with those from the remainder of the field and data of this block after curing were therefore unobtainable.

Rainfall records were kept throughout the experiment.

RESULTS

It has been stated above that the plots on which the experiment is based consisted of 26 plants. In many of the plots vacancies occurred, the lowest number of plants in any one plot being 22 at the conclusion of the experiment. The data recorded below are therefore based on plots of 22 plants, the excess being eliminated at random in each instance.

The experimental area was selected for the uniformity of stand of tobacco and it may fairly be assumed that there were no significant differences in the numbers of leaves present on the plants in the various treatments before the first or preliminary harvest. In table I are recorded the total numbers of leaves and the numbers of " clean " leaves in the plots (of 22 plants) at the time of the first examination, five days after the preliminary harvest.

An analysis of variance of the total numbers of leaves yielded, for treatments, a value of z lower than the 5 per cent. point. From this it may be assumed that the population, as determined by numbers of leaves, was a homogeneous one after the first or preliminary harvest. It may therefore be concluded that this harvest did not take the form of a selective picking.

In the following analyses no correction has been made for leaf numbers, as such a correction was considered to be unnecessary. Differences shown to be significant by the crude analysis would merely have been accentuated if such a correction had been made.

TABLE I

COUNT OF LEAVES IN PLOTS BEFORE MAIN HARVEST

	TREATMENTS								Totals	
	Unsprayed control (0)		Sprayed on							
			7-1-37 (1)		26-1-37 (2)		20-2-37 (3)			
	Total	" clean "	Total	" clean "	Total	" clean "	Total	" clean "	Total	" clean "
Block A	156	29	195	15	155	111	199	5	705	160
,, B	156	9	176	10	136	103	152	15	620	137
,, C	150	10	175	6	173	101	157	17	655	134
,, D	182	18	195	9	169	113	178	15	724	155
,, E	157	2	150	4	127	58	132	4	566	68
Totals	801	68	891	44	760	486	818	56	3270	654
Means	160·2	13·6	178·2	8·8	152·0	97·2	163·6	11 2	163·5	32·7

Results of Field Observations.—In the observations recorded in table I, the term "clean leaves" was arbitrarily adopted to include those leaves which had up to two frog-eye spots on them. This standard was used since the presence of two spots on leaves was, for all practical purposes, negligible and the higher figures so obtained were more useful for comparison. An analysis of variance of the numbers of these " clean " leaves in the 22 plant plots is given in table II.

The value for z for treatments is very much higher than the 1 per cent. point, indicating a high level of significance. From this analysis, it may be concluded that the first and third sprayings had no effect on the incidence of frog-eye on the plants as measured immediately before harvesting. The mean numbers of clean leaves in these two treatments were actually less than in the controls although the differences were well within the limits of normal variation, and were therefore not significant. It is concluded that the first spraying was done too early and the final spraying, as was expected, was done too late to be effective. On the other hand, the effect of the second spraying, as judged by the number of clean leaves on the plants before harvesting, was most marked.

In comparing these figures with those of cured leaves, it should be remembered that these were derived from a count of all the leaves on the plants. Immature leaves and badly spotted leaves were not gathered for flue-curing at the main harvest.

Results of Examination of Cured Leaf.—As is stated above, the second or main harvest was flue-cured and the cured leaf was brought to Peradeniya for detailed examination in the laboratory. The cured leaf from each of the plots was first weighed and then counted. Subsequently, the cured leaves were classified according to the numbers of lesions, of both frog-eye and barn-spot, found on them. Here again, an arbitrary classification had to be adopted. Barn-spot lesions are usually small and a cured leaf with up to 50 lesions is, for all practical purposes, clean and of good appearance. The leaves were therefore classified in groups of leaves with 0–25, 26–50, 51–100 and more than 100 lesions.

The data obtained are recorded in table III.

TABLE II

ANALYSIS OF VARIANCE OF RECORD OF "CLEAN" LEAVES IN PLOTS BEFORE MAIN HARVEST

Due to	Degrees of Freedom	Sum of squares of Deviations	Variance	$\frac{1}{2}\log_e$	Z	One per cent. point
Blocks	4	1357·7	339·42	2·9136		
Treatments	3	27792·6	9264·2	4·5669		
Error	12	1315·9	109·66	2·3490	2·2179	0·8919
Total	19	30466·2				

Standard Deviation = 10·48

Co-efficient of variability = 32·1%

Mean Numbers of " Clean " Leaves per Plot					S.E. of Mean of 5 plots	Significant difference
(0)	(1)	(2)	(3)	General Mean		
13·6	8·8	97·2	11·2	32·7	4·68	15·25

TABLE III

DATA FROM CURED LEAF

Treatment	Block	Wt. of cured leaf in Drachms	Total No. of cured leaves	Nos. of leaves with			
				0-25 lesions	26-50 lesions	51-100 lesions	> 100 lesions
(0)	A	53	22	1	1	8	12
Unsprayed control	B	32	15	0	1	1	13
	C	42	15	0	1	1	13
	E	42	24	0	1	1	22
(1)	A	38	17	0	1	1	15
Sprayed on 7-1-37	B	69	28	0	2	4	22
	C	42	16	0	1	0	13
	E	40	19	0	1	1	17
(2)	A	97	37	35	1	1	0
Sprayed on 26-1-37	B	77	35	31	3	1	0
	C	105	37	29	5	2	1
	E	56	31	25	3	1	2
(3)	A	60	37	4	12	14	7
Sprayed on 20-2-37	B	44	22	1	1	3	17
	C	47	18	0	1	1	16
	E	22	14	0	1	1	12

In table IV, the yields of cured leaf from the plots are subjected to an analysis of variance. The value of z for treatments is greater than the 1 per cent. point which indicates a high level of significance. This analysis again shows that the first and final spraying were without effect, the differences between the figures for these treatments and for the control being insignificant. The second spraying, however, resulted in a marked and significant increase in the yield of cured leaf. This increase was not due to a greater production of leaf tissue by the plants subjected to the second spraying, as can be seen from the pre-harvesting figures. The increase was due to the fact that heavily infected leaves were not harvested for flue-curing and that there was a relatively higher proportion of curable leaf than in the other three treatments.

The effect of the second spraying is further emphasized by a consideration of the numbers of lesions present on the cured leaf. In table V, cured leaves with up to 50 lesions (most of them were barn-spots) have been lumped together and considered to be "clean" and the figures subjected to an analysis of variance.

The value of z for treatments greatly exceeds the 1 per cent. point. It is shown that the results from the first and third sprayings are not significantly different from those of the control plants, whereas the second spraying effected a highly significant reduction in the amount of barn-spot on cured leaf.

Effect of Spraying on Quality of Cured Leaf.—Plants were examined after the field spraying. No deposit of fungicide was seen although the surface of leaves immediately after spraying looked rather more shiny than that of unsprayed ones. Examination of the cured leaf failed to reveal any differences in texture or appearance—other than in the amount of spotting—between the sprayed and unsprayed leaves. The cured leaf from the experimental plots was bulked with the rest of the tobacco and observations will be made later to determine, if possible, if the spray has any effect on the burning qualities of the leaf.

As has been noted above, no spray scorch was observed on any of the plants sprayed.

TABLE IV

ANALYSIS OF VARIANCE OF WEIGHTS OF CURED LEAF FROM PLOTS AT MAIN HARVEST

Due to	Degrees of Freedom	Sum of squares of Deviations	Variance	$\frac{1}{2}\log_e$	Z	One per cent. point
Blocks	3	1148·75	382·92			
Treatments	3	4736·75	1578·92	3·6823	1·0061	0·9724
Error	9	1900·25	211·14	2·6762		
Total	15	7785·75				

Standard Deviation = 14·53

Co-efficient of variability = 26·84%

Mean Weights of Cured Leaf per Plot in Drachms (0)	(1)	(2)	(3)	General Mean	S.E. of Mean of 4 plots	Significant difference
42·25	47·25	83·75	43·25	54·125	7·26	25·15

TABLE V

ANALYSIS OF VARIANCE OF NUMBERS OF "CLEAN" LEAVES HARVESTED FROM PLOTS AT MAIN HARVEST

Due to	Degrees of Freedom	Sum of squares of Deviations	Variance	$\frac{1}{2}\log_e$	Z	One per cent. point
Blocks	3	78·75	26·25			
Treatments	3	2828·25	942·75	3·4244	2·1261	0·9724
Error	9	120·75	13·42	1·2983		
Total	15	3027·75				

Standard Deviation = 3·66

Co-efficient of Variability = 36·18%

Mean Numbers of "Clean" Leaves Harvested per Plot (0)	(1)	(2)	(3)	General Mean	S.E. of Mean of 4 plots	Significant difference
1·25	1·25	33	5	10·125	1·83	6·34

METEOROLOGICAL DATA

The relevant rainfall records are given in table VI.

TABLE VI

DAILY RAINFALL RECORDS FROM 16th NOVEMBER, 1936 TO 25th FEBRUARY, 1937

(Rainfall measured at 9 a.m. each day for the previous 24 hours. Days on which no rainfall was recorded are omitted).

Date	Rainfall in.	Date	Rainfall in.
Nov. 16, 1936 ..	·04	Jan. 1, 1937 ..	·90
,, 17 ,, ..	·08	,, 3 ,, ..	·02
,, 18 ,, ..	·66	,, 6 ,, ..	·34
,, 20 ,, ..	·03	,, 7 ,, ..	·10
,, 22 ,, ..	·17	,, 10 ,, ..	·70
,, 24 ,, ..	·43	,, 13 ,, ..	·53
Dec. 8 ,, ..	·02	,, 14 ,, ..	·42
,, 9 ,, ..	·44	,, 15 ,, ..	1·10
,, 11 ,, ..	·03	,, 19 ,, ..	·97
,, 12 ,, ..	·13	,, 30 ,, ..	·05
,, 13 ,, ..	·02	,, 31 ,, ..	·60
,, 14 ,, ..	4·52	Feb. 2, 1937 ..	·95
,, 15 ,, ..	2·10		
,, 16 ,, ..	·36		
,, 17 ,, ..	·01		
,, 29 ,, ..	·90		
,, 30 ,, ..	·78		

During January, 1937, showers were relatively frequent and well distributed. The month included 10 wet days (more than 0·04 in.) and one rain day (0·01–0·04 in.). The total rainfall for January was 5·73 in. which was 1·9 in. below the average rainfall for this month during the five years 1931 to 1935.

The first spray was applied between 5 p.m. and 6 p.m. on the 7th January, there having been rain in the early morning. The leaves were dry at the time of spraying. Rain fell fairly regularly after this but it is not possible to say to what extent the fungicidal deposit was washed off.

The second spray was applied between 11 a.m. and noon on 26th January. No rain fell between the 19th January and the time of spraying. Between this date and the collection of the records of disease incidence there were only three wet days.

Rainfall during February was low. Apart from the heavy fall (0·95 in.) on 2nd February no rain fell during the whole month. The average rainfall for February for the period 1931–1935 was 2·33 in. This drought doubtless caused the early maturing of the tobacco and so upset the pre-arranged plan of experiment. It had been anticipated that the harvesting of the tobacco would not begin before the beginning of March. The drought may also have contributed to the efficacy of the second spraying in that the fungicidal deposit was not subjected to many showers which might have washed it off, at least in part.

The third spray was applied between 9 a.m. and 10 a.m. on 20th February. Weather conditions were dry and hot.

DISCUSSION

Field spraying of tobacco for the control of frog-eye and of barn-spot has not, apparently, been the subject of much experiment. Hill (1936) stated that field "spraying is uneconomic and unnecessary under Queensland conditions, since healthy seedlings can be obtained by applying control measures in the seed-bed." In a previous article on this subject, the writers (1937) concluded that nursery spraying is of great value in reducing the initial infection by frog-eye of tobacco after it is transplanted into the field. They also suggested that the soil is the main source of infection. Any new leaves which develop after the tobacco is transplanted, being unprotected by the fungicide applied in the nursery, are susceptible to attack by frog-eye. The plants used in the experiment described above were originally seedlings sprayed in the nursery and were, at the time of transplanting, free from frog-eye infection. The data recorded above indicate the extent of infection by frog-eye of the leaves of such plants at the time of harvest. These show clearly the need for the adoption in Ceylon of some control measure after the plants have left the nursery.

Meurs (1932) described the results of experiments on the control of frog-eye on tobacco in Sumatra. He recommended the field spraying of young plants with Bordeaux Mixture but pointed out that the spraying of plants more than twenty days after transplanting was inadvisable as a brownish-black or greenish-black deposit occurred on the fermented leaf from sprayed plants which completely spoiled the leaves for wrapper purposes. Hopkins (1934) reported that he had sprayed tobacco in the field for a number of years on an experimental scale. He mentioned the use of Bordeaux Mixture and also the less satisfactory use of fungicidal dusts. He concluded that field spraying was desirable but that further investigation was required to determine the number of sprayings required, the best times to spray and the kind of fungicide to be used and to solve practical questions, such as the discovery of the most satisfactory type of spray outfit.

From the above, it would appear that very little exact information on the field spraying of tobacco is available. The experiment described in the body of this article was therefore designed to determine if a single spraying would give satisfactory control of frog-eye and to determine, within wide limits, at what stage of the plant's growth the spray would be best applied. Bouisol was selected as the fungicide for use in the experiment partly because it is easy to use but chiefly because it leaves no obvious spray deposit on the leaves and so would be less likely to affect the appearance of the cured tobacco than Bordeaux Mixture, which had been adversely reported on by Meurs.

In the experiment under discussion the time from transplanting to the gathering of the harvest was 102 days. The different sets of plots were sprayed 55 days, 74 days and 99 days respectively after transplanting. The first and third sprayings were found to have no effect and it is concluded that the first was too early and the third too late to exercise any marked control of frog-eye infection. The second spraying, however, gave excellent results as judged by the number of frog-eye lesions present before harvesting, by the weight of flue-cured tobacco harvested and by the amount of barn-spot that occurred on the cured leaf. This second spraying was done at about the time of topping.

It is obvious that the determination of the optimum time of spraying should not be made purely by empirical methods and the experiment described above must be regarded as preliminary to more detailed experiments which are planned for next season. It is proposed to carry out then, side by side with a more elaborate experiment based on the results already obtained, a study of the course of infection by *Cercospora nicotianae* throughout the season and of the growth rate of the plants so that it may be determined on theoretical grounds at which stage the spray would be likely to be most effective.

It is obvious that, if a single field spraying has a marked effect on the amount of spotting, its practicability must receive careful consideration. No attempt has been made to consider the question of costs and to compare the costs with the increased value of the crop obtained in this experiment. The question will receive attention next season.

The effect of weather conditions on the incidence of frog-eye has not received special attention in this experiment. One point is, however, worthy of note. Weather conditions subsequent to the second spraying were unusually dry. The difference in the amount of spotting observed between the plots which were and which were not sprayed at this time was marked. This difference is due to infection which took place after the second spraying and it must therefore be concluded that frog-eye infection takes place in the absence of wet weather conditions.

CONCLUSIONS

From the experiment described above the following conclusions are drawn :—

1. That a single field spraying of tobacco with colloidal copper, applied at about the time of topping, reduced markedly the amount of frog-eye infection, resulted in an increased crop of leaf suitable for flue-curing and reduced the amount of barn-spot on the cured leaf.
2. That single field sprayings applied about three weeks earlier and three weeks later than this had no effect.
3. That heavy frog-eye infection took place during dry weather.

ACKNOWLEDGEMENTS

The thanks of the authors are again due to the Divisional Agricultural Officer, North-Western Division, for his co-operation in the experiments and, especially, to Mr. A. B. Attygalle, Farm Manager, Wariyapola, for his helpful and willing assistance in the organisation of the field arrangements.

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Thunia Marshalliana Rchb. f.

NOTES ON ORCHIDS CULTIVATED IN CEYLON

THUNIA MARSHALLIANA RCHB. F.

K. J. ALEX SYLVA, F.R.H.S.,
SUPERINTENDENT OF PARKS, COLOMBO MUNICIPALITY

THIS beautiful ground orchid belongs to a small group of about a dozen species of herbaceous forms which are confined to Burma and Northern India.

The genus *Thunia* is closely allied to *Phaius* but can be easily distinguished by many striking differences. The few known species of *Thunia* are all remarkable for their pretty foliage and large attractive blooms which would become any collection.

Thunia Marshalliana inhabits the Moulmein Hills of Burma where it grows on the ground among ferns and shrubs and, occasionally, on low forks of trees and in rock-depressions where vegetable matter accumulates.

The general appearance of the plant is that of a miniature bamboo clump about three feet high and its succulent reed-like pseudobulbs, which are clustered together, have a graceful droop. The base of the pseudobulb swells into a roundish tuberous knob beneath the soil and gets a firm hold to anchor the plant. The upper part of the young stems are clothed with oblong-elongated true leaves, 6 to 10 inches long by 2 to $2\frac{1}{2}$ inches wide, while the lower nodes are furnished with expanded, circular, reflexed leafy sheaths clasping the stem. On the completion of its growth the flowers are produced on a short terminal semi-drooping raceme. The flowers are large and waxy-white, delicate in appearance and measure about four inches across. The sepals and petals are lanceolate-oblong, almost of equal size and about 2 to $2\frac{1}{2}$ inches long. The outer surface of the lip is white and its lower part surrounds the column ends in a retuse falcate spur. The margins of the

expanded front of the lip are delicately fringed with yellow crystalline hairs which also occupy the disc.

The yellowish-green bracts are boat-shaped and enclose the flower while in bud but droop as the flower advances in age. The column is enveloped by the lateral lobes of the lip, which are of a yellowish tint with light pink veins extending to the throat. Two prominent toothed wings near the tip of the column form a hood.

Culture.—Thunia as a rule prefers the cool atmospheric conditions of the hills above 1,500 feet altitude, but offspring of some of the better acclimatised species could be cultivated below this elevation. Thunias are all deciduous in habit and require different treatment from that given to evergreen terrestrial orchids. On the completion of season's growth the foliage begins to decay and, at this time, the plants require a long rest which can be afforded to them by removing them to a dry and cool place. During this dormant period the plants need only just sufficient moisture to keep the stems from undue shrivelling. This treatment should be continued for about three months when plants will again begin to show signs of growth, especially when the atmosphere is humid during the rains. At this stage, the old stems may be cut from the base for propagation of the stock and the young growths separately potted. After removing the dead roots, the young plants should be potted in fresh compost covering only up to an inch below the rim of the pot and exposing the young growth just above the surface soil. A good mixture of turfy soil, leaf mould and silver sand (about equal parts) with a light sprinkling of decayed cattle manure is most desirable for all Thunias, as in this compost the stems become robust. When the plants are in active growth weak liquid cattle manure may be used with advantage.

Thunias are easily propagated by cutting the matured pseudobulb into sections with at least two nodes to each and burying these sections flat about half an inch deep in a porous compost made up of sand and leaf mould, or they may be inserted in the same manner as ordinary cuttings in light soil. The buds at the nodes give rise to plants in due course. The plantlets that develop at the nodes of matured pseudobulbs may also be used for multiplying stock.

DEPARTMENTAL NOTES

A NOTE ON THE COTTON PURCHASE SCHEME, 1936

H. A. PIERIS, B.A. (Cantab), A.I.C.T.A. (Trinidad),
DIVISIONAL AGRICULTURAL OFFICER, CENTRAL DIVISION

DURING 1936, the purchase of village cotton was undertaken in the Southern, Central and South-Western Divisions by the respective Divisional Agricultural Officers. A larger area was brought under cultivation than previous years and the quantity of seed cotton purchased, particularly in the Southern and Central Divisions, was specially higher. The price paid for first grade seed cotton was Rs. 12 per cwt. less handling and transport charges which varied according to the purchasing centre. The money due to cultivators was paid in full on the day of purchase. This method of spot cash payment has found favour with the producers, as they receive money at a time when, in most cases, it is urgently required for domestic needs.

The season on the whole was good for cotton except that a portion of the crop was damaged by untimely rain at Embilipitiya, Middeniya and Dambulla. Malaria too was a factor that militated against the cultivation and maintenance of plots. In the Southern and Central Divisions, the crop purchased was more than double the quantity purchased in the previous year. This is most encouraging, considering that the epidemic of malaria had not altogether abated during the sowing season and cultivators were considerably undermined in health.

The area under cotton was approximately 1,160 acres in the three divisions, namely, 700 acres in the Southern, 400 in the Central, and 60 in the South-Western Divisions. The total

crop purchased was 3,029 cwt. of seed cotton. A crop of 200 cwt. produced in the Galewella District in Dambulla range was disposed of direct by the growers. Taking this amount also into consideration, a crop of 3,229 cwt. of seed cotton was produced from 1,169 acres, approximately $2\frac{3}{4}$ cwt. per acre. Since most of the area under cotton was chena land, the yield per acre is satisfactory.

In the Southern Division, the present chena system allows for one acre of cotton to each cultivator on his two acre kurakkan chena permit. Crop rotation is not generally practised, as the size of the average holding is small and the rotation of crops is impracticable in chenas.

In the Matale district of the Central Division cotton cultivation, which is a new enterprise, has made steady progress each year since its inception. It is of interest to note that in this area the first cotton purchase, which was held in the year 1931, realised a sum of Rs. 283 only, while in 1936 the purchase has realised for the growers a sum of Rs. 7,269 approximately. Cotton has become a popular crop in Walapane district in the Central Division where a purchase was held for the second time during this year.

Altogether 1,080 cultivators grew cotton in the three divisions during the season under review—702 in the Southern Division, 308 in the Central Division, and 70 in the South-Western Division.

The cotton purchase was conducted during the first two quarters of the year, at selected centres where cultivators were easily and conveniently able to bring their produce for sale. The seed cotton was examined, sorted, graded and weighed at each centre before payment was made, under the supervision of the Divisional Agricultural Officers who conducted the purchase and who acted as Agents for the Spinning and Weaving Mills, Colombo, whither the produce was finally despatched.

The price paid to cultivators was Rs. 10·50 per cwt. of first grade cotton at Bata-ata and Rs. 10·25 per cwt. at all other centres in the Southern Division. It was Rs. 10·50 at all the centres in the Central Division and Rs. 10 at Embilipitiya in the South-Western Division.

The purchase centres in the three divisions were as follows :—

Southern Division :—

1. Bata-ata
2. Middeniya
3. Liyangahatota
4. Hambantota
5. Tissa

Central Division :—

1. Nalanda
2. Dambulla
3. Galewella
4. Walapane

South-Western Division :—

1. Embilipitiya

Details are given in the table.

THE FOLLOWING ARE THE PURCHASE FIGURES AT THE SEVERAL CENTRES

Division	*Centre*	*Number of Growers*	*Acreage*	*Quantity of Seed Cotton*			*Total*			*Cash Payment*			
				Cwt.	qr.	lb.	Cwt.	qr.	lb.	Rs.	Cts.	Rs.	Cts
Southern	Bata-ata	200		740	–	–				7,766	00		
	Middeniya	320		592	–	–				6,068	00		
	Liyangahatota	76		424	–	–				4,347	00		
	Hambantota	39		139	–	–				1,423	00		
	Tissa	67–702	700	148	–	–	2,043	–	–	1,514	78	21,118	78
Central	Dambulla	234		618	–	13				6,221	17		
	Nalanda	14		38	3	17				403	76		
	Galewella	36		64	3	21				669	16		
	Walapane	24–308	400	36	1	26	758	1	21	335	32	7,629	41
South-Western	Embilipitiya	70–70	60	227	2	22	227	2	22	2,199	46	2,199	46
		1,080	1,160				3,029	0	15			30,947	65

SELECTED ARTICLES

HOW TO FEED YOUR FOWLS*

IN the Journal of Agriculture of September, 1934—page 442 onwards, we considered the feeding of a pullet for eggs and growth. It is now desirable to consider the next step, that of keeping the egg supply at its highest point, while at the same time seeing that there is no undue strain on the constitution of the birds. One gets quite used to the expressions "too fattening" and "too forcing"; but what do they mean ?

No person who studies his birds will fall into the mistake of feeding the wrong class of feed to his stock.

It was mentioned that, "You put into the birds what you want, not what the bird desires." An undue fatness or forcing of a flock is entirely due to mismanagement—wrong feeding—and the blame can only be laid at the door of the person feeding. The fowl has no choice in the matter.

How many have told you that "blacks (Australs) are no good—they go to fat," and yet how many have ever considered that the feed given to the blacks is too fattening ?

The three commercial breeds in Western Australia are the Australorps, the Rhode Island Reds and the White Leghorns, totally different in type, shape, size and characteristics. The Austral is naturally a sluggish bird. Its weight makes it so. Being of tame disposition it hangs round the attendant —it is never flighty —matronly—wishing to carry on its work efficiently.

The Rhode Island Red is more active, quite as heavy as the Austral, built differently and needs treating differently.

The White Leghorn is the flighty bird, always on the go, always hunting, snatching—very alert. Yet our industry will try to obtain efficiency from each breed by feeding all on the same rations.

When discussing this problem we must realise that our range of foodstuffs in Western Australia is restricted to wheat, bran, pollard, milk in its various forms such as separated, skimmed, buttermilk and dried buttermilk, meatmeal, bonemeal and perhaps oats and barley, and from these ingredients we must make a balanced diet for our poultry.

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*By G. D. Shaw, Poultry Adviser, Department of Agriculture in *Journal of The Department of Agriculture, Western Australia,* Vol. 13 (Second) Series, No. 4, December, 1936.

All foodstuffs fed to poultry must be sound and wholesome.

The food when consumed performs definite functions and must contain the necessary elements to make and repair tissue—create heat and energy, produce feathers, eggs, and body growth.

The feeding values of foodstuffs is determined by the percentage of the various components, such as—

Proteins
Carbohydrates
Fats and Oils
Minerals
Fibre and Moisture.

Protein is a nitrogen-containing food element used for flesh-forming—the building up of waste tissue, and most essential for egg production.

Carbohydrates are made up largely of starch, sugars, gums, etc., which produce heat and energy and form body fats.

Fats and oils are essential heat and energy-producing elements, and assist in building up body fats.

Ash is the residue of burnt up foods and contains the minerals necessary for development of bone and feathers, and the formation of egg shell.

Fibre is the outer cells of grains and the fibrous matter in plants, and is not digestible ; but a percentage is always present and is necessary to assist digestion.

Moisture in varying proportions is found in all foodstuffs.

Protein is the most expensive ingredient of any feed. It will produce heat and energy, but as a source of heat and energy is too expensive. We therefore concentrate on other ingredients high in carbohydrates and fats when we desire our energy-forming foods. Let us now examine the foods for protein and carbohydrates.

			Protein	Carbohydrate	Moisture
Wheat ..	..	contains approx.	1 part	7 parts	12%
Bran ..	..	,, ,,	1 part	5 parts	8%
Pollard ..	..	,, ,,	1 part	6 parts	9%
Skimmed & separated milk	..	,, ,,	1 part	2 parts	88%
Dried buttermilk	..	,, ,,	2 parts	3 parts	
Meatmeal	..	,, ,,	2 parts	1 part	9%

One should realise that the sluggish bird must put on fat if the ration contains an excess of fat and carbohydrates. One should also realise that the active bird can utilise more carbohydrates and fats than the more sluggish breeds. Yet it is the prevailing practice to run both light and heavy breeds together in the one run. It is also the prevailing complaint to hear that, while the heavy breeds get too fat, the light breeds break down.

Go into any yard which contains both heavy and light breeds and handle them. One will notice that if the ration is excellent for the light breeds, the heavy breeds will be overfat and sluggish.

Go into the yards which feed efficiently for the heavy breeds and you will find that the light breeds are worn out and do not do justice to the breed.

A little intelligent observation will convince any reasonable farmer that something must be wrong, but how many correct this fault ? It is generally a condemnation on the breed, not on the person managing the flock.

Even the oldest poultry farmers whose main boast is that they have been feeding fowls for 20 years, etc., will not listen when told that different rations must be fed to birds of different make-up.

One is not of course suggesting that each breed should have a ration all to itself, but one is suggesting that each weight class must have different rations. Heavies one ration, lights another and medium heavies another. When this idea is practised, then and then only will one be successful with all known commercially profitable breeds.

The light breed bird is naturally very active, and we do know that activity uses the carbohydrates in the ration.

The heavy breed is naturally sluggish and we should realise that it cannot use all the carbohydrates which are in the ration fed to the lighter breeds.

Therefore, it is only natural that when the farmer admits those opposite characteristics, he will compensate the active breed by the higher proportion of carbohydrates to protein, and that the heavy bird must not receive as great a proportion of carbohydrates as a light breed bird.

If we admit this argument logical, we can then endeavour to manage satisfactorily. If we will not admit those facts we will continue to have mismanagement in feeding.

Let us examine any mixed flock of light and heavy birds. Wave the arm and see the activity of the light breeds—using carbohydrates all the time. The heavy bird will move more slowly. We often complain that White Leghorns are " too flighty " and we should then realise that their activity allows them to use more carbohydrates than the bird which is " tame."

It was explained that a balanced ration had one portion of protein to about 4·5 portions of carbohydrates and fats.

If the ration is so constituted that it contains one part protein to less than 4·5 carbohydrates, the ration is said to be " narrow."

If the proportion is greater than one part of protein to five parts of carbohydrates the ration is said to be " wide."

It will be noticed that wheat is " wide," but bran is nevertheless nearly balanced. However, bran is useless when fed alone, owing to its bulky nature ; yet it is very valuable when used as an essential ingredient giving a vegetable

protein. Pollard is "wide," milk is "narrow," and meatmeal exceptionally so. Hence we balance the rations of wheat, bran, pollard, etc., and adding the highly concentrated protein foods (milk and meatmeal) in such a way as to ensure palatability and nutriment sufficient for growth, repair of waste tissues, energy and eggs.

When considering any ration we must concentrate on the dry ingredient basis for all calculations. Moisture is not feed in the true sense. Water is essential but we must never consider it when talking of feed and feeding values.

The ration given on page 442 and onwards of the September, 1934, Journal of Agriculture are safety rations. When fed to pullets they will give size and production, and any who have had confidence in that ration will naturally enquire when anything goes wrong. Those who do not have confidence in those rations will not enquire for further advice.

Eight parts green feed, 5 parts bran, 3 parts wheatmeal, ½ part meatmeal (60 per cent. protein) and ¼ part bonemeal—1 part oilcake for morning wet mash, and a dry mash of the same ingredients (leaving out oilcake or greens of course in the dry mash), before them all day, with wheat and greens at evening meal, will prove an excellent ration for light breeds. The pullets will thrive, and the hens will lay plenty of eggs. Generally it is neither too fattening nor too forcing; but when fed to heavies or medium heavies we will have fat birds. The carbohydrates are too great in proportion to the proteins. It is too "wide," we cannot alter the position by cutting down the carbohydrates—that would be starvation, but we can alter it by adding more protein and the only proteins we have in Western Australia are meatmeal and dried buttermilk—nothing else—hence we must add more of the meatmeal and buttermilk (if used).

Our farmer now complains that he must mix three mashes in the morning. He can if he likes work, but he can mix the rations quite easily if he cares to organise. Wet mash in the morning. Dry mash hoppers all day and wheat at night. We can alter our rations in the dry mash hoppers and mix the one wet mash to feed all birds.

It has been found by experiments at Muresk that while the light breed could thrive on 5 measures bran, 3 wheatmeal, ½ meatmeal, ¼ bonemeal in both wet and dry mash, the Rhode Island Reds needed ⅝ measure of meatmeal in the dry mash hopper and the Australorps needed 11-16 measures of meatmeal.

By feeding the one wet mash to all breeds, and by altering the dry mash meatmeal proportions to ½ for lights, ⅝ for Rhode Island Reds and 11-16 for Australorps we obtained as near a balanced ration as required for each respective breed.

Let us for a moment assume we are managing a farm containing 400 White Leghorn Pullets, 400 Rhode Island Red Pullets and 400 Austral

Pullets—1,200 in all, and quite a good sized farm for one man to manage. We will have 3 or 4 yards of each breed. In the dry mash hoppers we will have the following rations by bulk measurements—not by weights :—

Lights.	R.I.R.	Australorps.
5 Bran	5 Bran	5 Bran
3 Wheatmeal	3 Wheatmeal	3 Wheatmeal
½ Meatmeal (60% protein)	⅝ Meatmeal (60% protein)	11-16 Meatmeal
¼ Bonemeal	¼ Bonemeal	¼ Bonemeal
½ Keymeal	½ Keymeal	½ Keymeal

As you cannot easily incorporate oilcake to the dry ration, keymeal can be used by putting in each hopper the proportion of ½ measure.

In the morning—mix 8 greens, 5 bran, 3 wheatmeal, ½ meatmeal, ¼ bonemeal and 1 of oilcake damp measure (or ½ key-meal) as a wet mash and give to all birds.

We will be able to satisfy the appetite of the stock with approximately a 4 gallon tin of wet mash to 100 birds. Any birds that have been eating from the dry mash hoppers will leave and partake of the wet mash.

The hopper mash is now available to all birds, some of which may have been modest—others hungry.

The dry mash hopper is used only by the layer and care must be taken to see that the hopper contains the high protein percentage of the wet mash.

One will notice that the wheat consumed does not reach the 2 oz. figure. This is the ultimate result of the three feed system. The amount used will average about 1½ oz. per bird.

It will thus be seen that the balance is out of proportion to the 2 oz. of mash, to 2 oz. of wheat. This aspect wants to be thoroughly studied. If one works out a balanced ration on the 5 bran, 3 wheatmeal, ½ meatmeal, ¼ bonemeal and ½ keymeal (or 1 oilcake—damp measure) with 2 oz. wheat at night, one will find that the ration is slightly wide, but not wide enough to unduly fatten the light breeds.

The birds by partaking of the dry mash hopper feed, naturally consume more of the mash in proportion to the wheat, and this helps to bring the ratio nearer to 1-4·5 or 1-4·8. Nevertheless, we can overdo it. We must be very careful to see that the wheat portion is kept up to the balance. If the grain feed is not relished by the birds lower the morning portion of mash and add more ground wheat to the dry mash hopper.

We will find, however, that those proportions will certainly fatten both Rhode Island Reds and Australorps. The latter bird more so. Hence the three dry mash rations have been given in order to start on a definite basis.

Having divided the flocks into yards containing only one breed of fowl it is then a simple matter to feed each breed properly by the correct proportions of protein in the dry mash.

This method will overcome the common complaint that the heavy breeds "get fat." One is only "putting into the birds what one wants, not what the bird wants."

Any fatness should be now confined to those obstinate individuals which will always get fat no matter what one may do. Cull them out.

Let us now proceed to feed the birds on the before-mentioned principles. We have filled the hoppers—let me mention that the hopper need not be an elaborate instrument ; even a 6 in. deep box will do to start and gradually improve—each hopper containing the separate proportion of proteins desired for the breed to be fed.

In the morning feed the wet mash, in the afternoon at 3·30 feed the grain —an amount they will eat ravenously. Don't leave any over. Then feed the green feed.

Watch the colour of the droppings of each breed—they should be all of the one colour after about a week of feeding this system. It is to the colour of the droppings we must look if we are to find out whether the ration is balanced. No two consignments of food are alike ; therefore, unless we compensate the variation in the feed by a variation in the proportions of the ingredients in the feed, the ration will not be consistently balanced. It will vary, and as such it is not satisfactory.

If the colour of all breeds is not even you must vary the proportion of protein in the dry mash, up or down until the colour is even. If one is lighter than the other, put up the percentage of protein in the dry mash feed to the birds passing the lighter droppings. Keep adding the percentage weekly until all are even in colour.

The colours of the droppings can vary from light yellow to dark brown, to black, then to a slight reddish tinge. Be careful that you are not confusing the colours if you are using charcoal or the soil is of a reddish nature. We must compensate for this, as the birds will consume the charcoal and soil and that will pass through, causing a false colour.

If it is yellow we have too much carbohydrates and fats to protein—the ration is "too wide."

If it is brown this means the same—"too wide."

If it is black-brown we have a ration as near as desired.

If it is black we are near the danger zone.

If it is red bloodish colour we are too narrow, and dangerous.

Aim for the black-brown colour—and satisfaction. Do not consider the white tips—these are urine and are of no importance to our discussion. Simply this—if light brown, too much wheat to meat ; if black-brown, O.K. ; if reddish, too much meat to wheat. Remedy by varying the meatmeal. It is the highly concentrated protein ingredient and it can influence the ration quickly.

When gauging colour take a quick glance for colour effect. Not an isolated concentration. When the colour is even for all breeds we have found the correct dry mash.

Should the general colour of the droppings of all breeds then lighten up, add more protein to the wet mash ; should they generally get too dark lower the percentage.

The principles governing the correct procedure are :—

(1) To change the colour of the droppings of an individual breed—alter the percentage of protein in the dry mash.

(2) To change the general colour equally of all breeds, alter the percentage of protein in the wet mash.

One can see that the same principles can be applied to all birds on the farm.

Chickens are fed dry mash for 8 weeks, then wet and dry ever afterwards. Laying pullets the same wet mash—with an altered dry mash. Hens the same wet mash—with the alterations in the dry mash. Cockerels, cocks and birds for market, still the same wet mash, but alterations in the dry mash hoppers.

This idea makes feeding definite, at the same time easy. The one wet mash in the mornings—and then only about half the quantity required in comparison to the two feeds a day system, and less wheat or grain at evenings. It cuts down the daily labour. It gives a balanced ration to all breeds. It insures sufficiency of maintenance rations and the requisite amount of egg-forming material. No breed gets overfat. None is worn out, and the egg basket is always full to the highest possible level. We have now definitely worked away from the rule of thumb methods and are applying commonsense feeding.

It is advisable to start immediately and, if doubts are expressed, try one yard of a breed on this system and see the results. More eggs and bigger eggs. The rest of the farm will then have dry mash hoppers installed as soon as possible.

We have only considered the feeding of gristed wheat, bran and whole wheat. When using pollard, one alters the proportions in the mashes to be four pollard and four bran, in place of five bran and 3 wheatmeal. The principles are similar. We also advocate the use of dried buttermilk. When using dried buttermilk, the meatmeal must be reduced equivalent in weight to the buttermilk added.

Skimmed, separated or buttermilk can be used with advantage. But one must realise that all liquid forms of milk are so much moisture and so little dry ingredients, and that one cannot substitute four gallons of liquid milk for four gallons of meatmeal. One can only substitute the protein portion of the milk for the same amount in meatmeal. The moisture content is very high, and we cannot substitute water for meatmeal. When using these milk

forms it is safer to use all you can, leave the meatmeal proportion as previously used, and then fluctuate the quantity of meatmeal as designated by the colour of the droppings under the perches.

Rabbits, kangaroos, etc., are not meatmeal—they again are so much moisture and so little protein. They have a low dry matter percentage.

A bird cannot consume enough livers, sheep's heads, fresh meat—rabbit or kangaroo—to obtain the requisite amount of protein required. The crop and digestive organs are not large enough. But we can use these meats to help reduce the meatmeal. Substitute the fresh meats for a portion of the meatmeal by again watching the droppings.

Wheat, of course, is the standard feed on country farms, and wheat is therefore used in all forms—boiled, soaked, gristed and whole. All wheat feeding is satisfactory provided one is assured that the birds obtain the requisite amount of dry matter, irrespective of how the wheat is treated, and that the wheat feeding is balanced with the correct amount of meatmeal and or buttermilk.

One can soak or boil the wheat with skim milk or buttermilk, but one cannot eliminate the dry basis quantities. Meatmeal is still required. The farmer can substitute any grain available in the place of wheat, but he cannot find a substitute for the correct percentage of protein in the ration—he can help with milk in all its forms (except fresh milk), he can assist with animal flesh, but he must still rely on some form of concentrated protein, and we only have the two forms in Western Australia—meatmeal and dried buttermilk.

With the best of management some birds will get fat—these individuals are the exceptional birds which should be "culled." Others again will lose condition—"cull" these also. It is the general condition of a flock which counts, and not any particular bird. Do not starve the flock to reduce fatness. The method of starving to reduce fat is a prevalent practice in the industry and causes lack of condition and loss of production.

If the ration has been wide, the carbohydrates and fats that are not immediately used are stored within the body of the bird as layers of fat. This fat may gradually accumulate until the bird is useless as a laying bird.

We can realise that the only reasonable way to reduce the fat reserve is to make the body demand the use of that extra fat, and to do this one must slightly, but ever so slightly, increase the protein proportion of the ration until the ration is a shade on the "narrow" side. This will then create the demand for more carbohydrates and fats to balance the diet, and so the bird will draw upon the reserve already accumulated for such emergency. This is a long and tedious process. It may be necessary for some special individual birds, but is hardly economical where a flock is affected by overfatness. The surest means is to see that the birds never have access to a ration other than that desired by the farmer.

"Put into the birds what you want." Your birds will then be layers when layers are wanted, and fleshy birds when aiming for table poultry.

CARNAUBA WAX*

THE general lack of knowledge of the production of many industrial raw materials, originating in remote corners of the world, is sometimes appalling to the scientist. Carnauba wax, of which about 4,800 tons of an annual production of over 10,000 tons are imported into the United States, is a typical example of a raw material, very important to certain industries, of which the lack of first-hand information of the source and processing has been outstanding. This wax is used in the manufacture of polishes for floors, automobiles, furniture, shoes, etc.; in candles to raise the melting point; in carbon paper; and in a variety of molded products. Articles published by scientific men in technical and trade papers reveal a curious lack of accurate information about this wax in any stage of its production or in any form other than that in which it appears on the market.

With the purpose of investigating the source of carnauba wax and studying its production, an expedition was organized by S. C. Johnson & Son, Inc., last fall to visit the carnauba country of North-eastern Brazil and to study more closely the growth, harvesting and recovery of this important raw material. In order to reach quickly the remote parts of the country where carnauba wax is produced an airplane expedition was planned. The party, including pilots and the writer, consisted of six members led by H. F. Johnson, Jr. The airplane was an S-38 two-motor, Sikorsky amphibian equipped with facilities for two-ray radio communication. The Pan-American Airways were of great assistance and the facilities of their organization were used wherever available.

PREPARATIONS

Months were given to careful planning and preparation for the flight. All available literature from the Department of Agriculture of Brazil and from other sources was gathered and studied to determine the exact location of the known stands of carnauba palm trees. From this accumulated information a composite map was prepared and the city of Fortaleza in the state of Ceara was selected as a base for operations. From this city routes to the various centres of production were planned. Preparations were then made for gasoline supplies at various strategic points along the coast of South America and at numerous inland towns.

Since we were contemplating a trip into territory which is sparsely inhabited, and our means of transportation was such that we might be forced to

* By J. Vernon Steinle, S. C. Johnson & Son, Inc., Racine, Wis. in *Industrial and Engineering Chemistry*, Vol. 28, No. 9, September, 1936

spend considerable time in a wild and barren country, all of the usual paraphernalia of an expedition into such country were shipped to Fortaleza. Firearms, ammunition, auxiliary food supplies, camping and travelling equipment, and medical supplies, as well as scientific and laboratory supplies and complete photographic equipment, were sent.

Preliminary test flights were made with our 'plane carrying complete equipment and personnel. All safety devices were tested, and the personnel thoroughly instructed in their duties in an emergency. All special pieces of equipment were given extensive tests, and members of the expedition in charge of this equipment became thoroughly acquainted with it. The airplane after a complete overhauling was equipped with special safety devices, including a Sperry gyrocompass and artificial horizon. After six months of intensive preparation, the expedition was ready to leave Miami on October 1, 1935.

Following the route pioneered by the Pan-American Airways and using their facilities, our ship, the Carnauba, flew by easy stages to Para, our port of entry in Brazil, following the chain of the West Indies Islands along the border of the Caribean Sea. Our arrival in Para near the mouth of the Amazon marked the beginning of the difficulties which beset our expedition. On the night before our arrival darkness overtook us as we were spanning the 150 mile mouth of the Amazon. Caution forced us to land on the shores of a small island directly on the Equator. After spending an anxious night under the tropical skies, we proceeded the next morning to Para. The officials there met us with the utmost suspicion because of our unscheduled stop on the island. This initial suspicion seemed to follow us through our stay in Brazil. In spite of our careful planning and the assurance of our State Department that everything was satisfactorily arranged, we were tapped again and again by the red tape of the Brazilian Government. We had difficulty in obtaining permission to fly the airplane over their territory, to take aerial photographs, and to gain possession from the customs of the equipment shipped in advance. Our inability to appreciate the Latin mastery of the art of delaying action on all matters until to-morrow, kept us in a constant state of agitation. Valuable weeks were lost in overcoming what seemed foolish and unnecessary difficulties, but in the end the original objectives of the expedition were achieved.

Our first venture into the back country was made to verify reports that large unexploited stands of carnauba palms might be found near the junction of the Araguay and Tocantins Rivers. The Araguay is the first of the southern tributaries of the Amazon and is joined by the equally large Tocantins about 200 miles to the south. Flying directly from Para and refuelling at the tiny native village of Maraba, we explored this entire region from the air, satisfying ourselves that the reports of carnauba growth in this section were unfounded.

We then left the sleepy city of Para and proceeded along the coast to the real centre of our operations in the busy city of Fortaleza. Here we established headquarters, set up our laboratory, and went to work in earnest.

LOCALE OF THE TREE

In general, the centres of production of carnauba wax lie within what is commonly described as the "shoulder of Brazil." The production is almost equally divided between the states of Ceara and Piauhy, with a little wax coming in from the neighbouring states of Maranhao, Rio Grande do Norte, Pernambuco and Parahyba. Flying over this land gave an excellent panoramic view of a country unique in that it is the only part of the world where the wax is obtained. The country consists of arid, alluvial plains dotted with hills and small mountains.

During the dry season the sparse vegetation, with the exception of the palm trees, takes on a gray dusty look. The soil, although our analysis shows it to be extremely fertile, appears sandy and is baked hard by the hot sun. All but the very largest rivers are completely dry. A notable example is the Jaguaribe. In the rainy season this is a mighty torrent about 300 miles long and several hundred feet wide along a great portion of its course. When we explored this region by automobile, we actually drove our car along the hard dry river bottom through the gardens which the natives plant during the dry months. During a few weeks in the early part of the year this region is subjected to torrential rains. All of the lowlands are completely flooded at this time and the dry earth and the thirsty plants soak up the water which they may not again receive for a year or sometimes two.

The Carnauba palm (*Corypha cerifera*) can grow in any tropical climate which is suitable for the growth of palm trees. However, with the exception of this particular locality, wax is not produced by the tree in commercial quantities. Nature has seen fit to coat all of its delicate plant structures with a thin cutinous layer of wax. The blossoms fruit, leaves and young shoots of all plants are protected with wax. In addition to the protection which this layer of wax affords against the destructive action of the atmosphere, the waxy coating aids in the conservation of moisture within the plant by preventing evaporation from the enormous expanse of exposed surface. The carnauba palm is a species of plant which requires a considerable amount of moisture in its life and growth.

In the carnauba wax region water is available to these plants for only a short period each year. During the time of the torrential rains, the carnauba palm soaks into its cells large quantities of water. In order to conserve this water and prevent its escape by evaporation, the plant builds up on the surface of its leaves a comparatively heavy coating of wax. This particular trick of nature is the reason why it was necessary for us to make this long trip to study at first hand this important raw material.

DISTRIBUTION OF THE TREE

The carnauba palm grows and produces wax over an extended area, but with the airplane we were able to cover it in a few weeks. A careful survey showed that the palm, although plentiful in most places where it is found does not cover as vast areas as might have been expected from previous reports. When observing the stands from the ground, their extent might easily prove deceptive. The aerial survey gave an exact picture of their distribution. The densest areas of growth and the largest centres of wax production are along the Jaguaribe River in Ceara, and in the Campo Naior district of Piauhy. Another large stand of trees in Piauhy is found on Government lands near Oeiras along the banks of the rives Itam and Canindc. Scattered growths of smaller area occur in many other parts of these two states and in the neighbouring states previously mentioned.

The stands of carnauba palm, in general, contain no other type of tree and are comparatively sparse in their distribution, although there are exceptions to this general rule. In certain places along active river beds the growth is so thick that we could not see the sun except at mid-day.

One extended flight of exploration took us far out of the normal area of wax production and south into the valley of the Rio Sao Francisco, where reports indicated that there were vast stands of unexploited carnauba. Although we found some small production of wax near the cities of Petrolina and Joazeiro in the state of Bahia, the growth of palm in this region was negligible in comparison to the vast stands in Ceara and Piauhy. In general, carnauba wax production does not extend south of 10 degrees south latitude.

The carnauba palm tree is of the fan-leaf type and grows to heights of 40 feet or more. The uncut trees have a beautiful ball of green leaves at the top. Because of the rigid conditions under which it lives, this palm grows slowly, attaining a height of only about 5 feet after 20 years. Only when the main trunk or stem of the palm has appeared is it safe to cut the leaves for wax production. This generally does not occur before the tree is ten years old. The carnauba grows entirely wild, and harvesting of the leaves takes place over a wide expanse of territory. New growth is propagated when the fruit or seeds of the tree are washed about and deposited by the torrential rains.

In the past few years some of the larger and more energetic landowners have experimented on a small and crude scale with the planting of carnauba palm in an orderly plantation arrangement. The success of these experiments cannot yet be determined since many years must elapse before the plants are large enough to yield a harvest.

Large tracts of land on which the carnauba grows are owned by the wealthier class of the Brazilian population who generally live in the cities, leaving the actual wax production to the natives who live on the land and gather the crops of the landowners.

PRODUCTION OF THE WAX

The actual production of carnauba wax is exceedingly crude. The original native methods of production have been little improved. The harvesters go forth into the *carnaubal* armed with a sharp sickle-like knife fastened to the end of a long pole. With this long-handled knife they cut the desired number of leaves from the trees. Harvesting takes place from about July to January; the time varies in different localities, depending primarily upon rainfall. A maximum of about twenty leaves can be cut from one tree during the season. This is generally done in about three cuttings—ten leaves on the first cutting and five on each of the subsequent two. The leaves are cut only from the upper half of the foliage ball because, when the leaves pass below the horizontal, they have lost a goodly quantity of their wax coating. A few leaves from each tree are cut from the cabbage of the ball before they have actually opened. From these closed leaves the lighter coloured grades of wax are obtained. As the leaves fall to the ground after being cut, workers gather them together, slash off the long stems and divide them at the same time into two groups—the open leaves or palhas, and the closed leaves or olhos. These freshly cut leaves are now transported, usually on the back of a patient donkey, to a natural open area where the drying field is located.

At the end of the day, the leaves are spread out in the drying field in neat rows, the olhos in one section and the palhas in another. Under the intensely hot sun the leaves are thoroughly dried in about three days.

As the leaves dry, the fibrous cells shrink but the wax coating on the surface does not, and therefore loosens from the leaf. The constant winds blowing in from the ocean not only help to dry the leaves but also blow off and dissipate a considerable proportion of this powdery wax coating. After the third day the leaves are thoroughly dry, and the labourers gather them carefully together, tie them into bundles, and transport them to an outbuilding near the main farm house.

In a small closed shed or hut, which when the door is closed has no opening other than a small 6-inch-square hole to admit a little light and air, the wax beaters work. These men stripped to the waist, do the most arduous task in connection with the production of carnauba wax. On a bench or stand in the middle of the room are mounted a half-dozen or more sharp knives pointing upward between two curved brackets. The beater takes a handful of leaves, two or three at the most, and draws them between the brackets through the maze of knives. This operation is repeated until the palm leaves are thoroughly slit. He then takes a short stick and pounds the cut leaves until all of the loose wax is removed. The cutting operation is necessary to open the closed portion of the leaves from which a great deal of wax is obtained. The spent leaves are generally thrown out of the hut through the ventilating opening, and the powdery wax is allowed to accumulate on the floor.

At the end of the day the powdered wax is gathered into baskets and tins and removed to the melting room. Here, in a thatched hut and over an open fire, the powdery wax is melted. Often an old 5-gallon gasoline can from which the top has been removed is used as the melting vessel. A full 5-gallon can of powder will melt down to less than a quart of molten wax. The wax is slowly melted over the fire, being stirred constantly during the operation. If a chalky wax called arenosa, is desired, a cup of water is added to the wax while it is melting. When no water is added the regular gorduroso or north country wax is produced. (When producing the light No. 1 or 2 wax, the wax powder beaten from the young, unopened leaves or olhos is employed). The molten wax, containing a great deal of leafy fibre, is quickly poured into a cheese-cloth held by two natives and is filtered. To obtain most of the wax from the residue the ends of the cloth are twisted, and the centre mass is squeezed with a pair of large wooden scissors. Some of the more modern establishments use a crude type of filter press. The cheese-cloth containing the molten wax is placed in a cavity in a log over the bottom of which strong fibres have been stretched. A block is placed on top of the folded cheese-cloth, and a long heavy pole is used as a lever to express the wax from the cake. The molten wax is caught in an earthenware pan and allowed to cool, and the broken pieces of wax thus obtained are now ready for the market.

This procedure of harvesting and wax recovery is commonly used in the state of Ceara. In Piauhy a slight variation is employed. Here scattered rainfall is more frequent, and, if an unexpected rain should occur while the leaves are in the drying field, the entire yield from that cutting would be lost. Therefore, in order to reduce the drying time to one day, the freshly cut leaves are carefully slit before they are spread in the drying field. The women and children of the worker's family sit about with long sharp knives with which they deftly slit the green leaves into fine shreds which still remain attached to the butt end of the leaf. The remainder of the operation is similar to that already described, except that greater care must be exercised in gathering the dried leaves since the powdery wax is even less firmly attached to these slit leaves than to the dry whole leaves.

The yield of wax per leaf varies with the age of the tree, the locality, and the amount of rainfall which has preceded the harvest. On an average, however, a leaf will yield about 5 grams of wax. Considering the maximum cutting of about twenty leaves from a tree, five carnauba palms will produce about one pound of carnauba wax a year. One native can handle about a thousand leaves through the complete process in a day.

FUTURE DEVELOPMENT

When we had gathered as much information from the natives as was available regarding the production of carnauba wax, small-scale laboratory experiments were conducted to clear up some of the questions raised at the time.

The Brazilians are very jealous of their vast natural resources, and with the loss of their rubber and quinine industries always uppermost in their minds, they quickly become suspicious of activities of foreigners which may effect the control of their natural resources. We were continually aware of this suspicion and exerted ourselves to win favourable public opinion. We believe that such favourable opinion was established and still remains. It is probable too, that our work will have the result of stimulating the interest of both the state and the federal government in the more careful study of carnauba.

The expedition and the careful investigations and experimental work done by the party is but the beginning of the program planned by S. C. Johnson & Son, Inc., for the study of carnauba wax. A tract of land has been purchased near Fortaleza, and an experimental station will be set up there to study plantation methods in connection with the growth of the carnauba palm and to develop improved methods for the production of a better and more uniform grade of carnauba wax.

CORRESPONDENCE

St. Patrick's College,
Jaffna,
7th May, 1937.

The Editor,
The Tropical Agriculturist,
Peradeniya.

Dear Sir,

I am enclosing a report from the teacher conducting our experiments in a Balanced Diet. I wonder if the enclosed could appear in the correspondence column of *The Tropical Agriculturist.*

Yours faithfully,
T. M. F. Long, O.M.I.

THE SOYA BEAN

The Soya Bean is described in an ancient Chinese dictionary as "Ta-teon" the grand pea. It well deserves this title because it is *facile princeps* among foods. One of the most important proximate principle is protein, which may be called the body brick. No food has such a large percentage of protein as the Soya Bean. It heads the list with 40 per cent. to its credit. Lentils come second with 25 per cent. and meat 24 per cent., while eggs have 14·8 and wheat 12. To those interested in dietetics this bean has a great fascination. While in charge of the Balanced Diet Experiment at St. Patrick's Boarding House last year, I was anxious to get a quantity of these beans, to see how much they would cost in a daily diet and whether they could go to make palatable dishes. Enquiries from the Department of Agriculture elicited the information that these beans were not grown in Ceylon. The Market Commissioner gave the address of a Colombo Firm which sold these beans. A trial order was placed. The cost however militated against a regular use of these beans. The beans were sold in Colombo at 25 cents per pound. The freight and the cost of grinding them into flour raised the price to almost 40 cents. The variety obtained belonged to the yellow group. A small quantity was roasted and ground. To all intents and purposes the powder passed off as coffee. That was the easiest way of preparing the bean as food. Attempts to grind the beans into flour with the rice pounder failed, the beans being too soft. A flour mill at Grand Bazaar came to our rescue. After the beans were passed three times through the mill, a fine flour was obtained. The flour was of a golden colour, almost like gram flour. The flour was used to make bread, buns, tarts and cake. These were very tasty. As the soya bean does not contain gluten, one part of soya was mixed with two parts of

dough to make bread and buns. Equal quantities of soya flour and wheat flour were used for tarts. A plain plum cake with soya flour proved delicious. The nutty flavour was eliminated by a liberal addition of butter, sugar and essence of vanilla. The number of eggs used was less than is generally used for plum cake as soya flour has 20 per cent. fat. *Rotti*, *Vadai* and other indigenous dishes were also tried.

As stated earlier, it was the cost that militated against a more extensive use of the beans. The price of flour at 40 cents makes it more than a luxury food for a Boarding House or for a matter of that even in the home. It is interesting to note that soya flour costs 9 cents a pound in India.

THE SOYA BEAN GROWN

Undaunted by the fact that Soya Bean was not grown in Ceylon, an attempt was made to grow it at Paranthan and at St. Patrick's Boarding House gardens. The variety tried belonged to the black group (with flat black seed). The first crop was given to me for experiment. This variety had an unenviable reputation as being unpalatable and unfit for human consumption. The bean being black, the flour with the unhusked bean would have been of a gunpowdery hue. The beans were therefore dried for more than two weeks and roughly pounded to remove the outer black husk. The husked beans were washed and dried several times to get rid of a rancid odour. The beans were then sent to the Grand Bazaar Mill to be converted into flour. The flour from this variety was almost the same colour as the previous one. Buns and tarts were made. The beans belied their evil reputation. The buns and tarts tasted well. We are sure that other appetising dishes can be made. An attempt to make Soya Bean milk and curds is contemplated.

C. W. D. Alwines.

REPORT OF THE PROCEEDINGS OF THE NINTH MEETING OF THE CENTRAL BOARD OF AGRICULTURE

The ninth meeting of the Central Board of Agriculture was held at Peradeniya, in the Board Room of the Department of Agriculture, at 10 a.m. on Thursday, 18th March, 1937.

His Excellency the Governor presided. The Hon'ble Mr. D. S. Senanayake, Minister for Agriculture and Lands, and Mr. E. Rodrigo, Acting Director of Agriculture and Chairman, were present.

The following members attended :—Sir. James P. Obeyesekera, Messrs H. W. Amarasuriya, M.S.C., S. Armstrong, C. Arulambalam, P. B. Bulankulame, A. Canagasingham, Dr. R. Child (Director of Research, Coconut Research Scheme), Messrs R. G. Coombe, M. Crawford (Government Veterinary Surgeon), E. C. De Fonseka (Jr.), C. N. E. J. de Mel (Acting Principal, School Farm and Experiment Station, Peradeniya), Wace de Niese, L. W. A. de Soysa, G. Bruce Foote, Dr. C. H. Gadd (Acting Director, Tea Research Institute), Messrs R. P. Gaddum (Chairman, Planters' Association of Ceylon), Bruce Gibbon, Dr. J. C. Haigh (Economic Botanist), Mr. L. L. Hunter, Dr. J. C. Hutson (Entomologist), Mr. Montague Jayawickrema, Dr. A. W. R. Joachim (Agricultural Chemist), Messrs J. S. Kennedy (Director of Irrigation), A. B. Lushington (Acting Conservator of Forests), S. M. K. B. Madukande, Dissawe, Mudaliyar S. Muttutamby, Messrs T. E. H. O'Brien (Director, Rubber Research Scheme), Graham Panditteseke re, Wilmot A. Perera, S. F. H. Perera, W. W. A. Phillips, F. A. E. Price, H. W. Ranatunga, Marcus S. Rockwood, B. M. Selwyn, Rolf Smerdon, A. T. Sidney Smith, E. L. Spencer Schrader, R. H. Spencer Schrader, U. B. Unamboowe, Ratemahatmaya, E. C. Villiers, M.S.C., Mudaliyar N. Wickramaratne, Mr. A. A. Wickramasinghe, Rev. Father L. W. Wickremasinghe, Mr. C. L. Wickramasinghe, Col. T. Y. Wright and Mr. W. C. Lester-Smith (Acting Secretary).

Visitors :—Messrs W. P. A. Cooke, Chas. A. M. de Silva, J. C. Drieberg, James W. Ferguson, N. K. Jardine, F. P. Jepson, E. J. Livera, A. Mahadeva, S. Pararajasingham, W. R. C. Paul, L. A. P. Pieris, H. A. Pieris, P. M. Renison and G. W. Sturgess.

Intimation of their inability to attend was received from the following members :—Mr. A. C. Attygalle, Col. K. D. H. Gwynn, Gate Mudaliyar D. H. Kotalawala, M.S.C., Dr. H. M. Peiris, Gate Mudaliyar A. E. Rajapakse and Mr. G. C. Rambukpota, M.S.C.

CONFIRMATION OF MINUTES

The President (His Excellency the Governor) stated that the minutes of the last meeting had been printed and circulated to all members and enquired whether there were any comments to be made upon them. As no comments were made the minutes were confirmed and signed by His Excellency.

Prior to passing on to the second item on the agenda, the President intimated that the Director of Agriculture desired to inform members the action taken on resolutions passed at the previous meeting.

Mr. E. Rodrigo said that before making further remarks he wished to convey to His Excellency their sincere and loyal thanks for consenting to come and preside over their deliberations. The President thanked Mr. Rodrigo for his remarks. Mr. Rodrigo then referred to the honour which had been conferred on their former Chairman, Mr. F. A. Stockdale, as he then was. He was sure they were all very proud of the recognition which his services to the agriculture of the whole Colonial Empire had received; he was also certain that the suggestion that they should convey to Sir Frank Stockdale their sincere congratulations would be received with such unanimous acclamation that it would not be necessary for him to request His Excellency to put it to the meeting as a formal resolution. The meeting indicated their unanimous agreement with this suggestion.

Referring to the resolutions passed at the previous meeting, Mr. Rodrigo said that to save time he had had statements prepared regarding the action taken on the several resolutions passed at the last meeting, and these had been circulated or were tabled. There was, however, one further matter to which he wished to make special reference. The previous Chairman of the Kurunegala Planters' Association had requested that the breeding of the coconut black beetle in decaying rubber logs should be brought to notice and an attempt be made to deal with such breeding places. As Director of Agriculture he had promised to give the Board an opportunity of discussing this and had suggested that the views of the coconut planting community, through their representatives, be placed before the meeting. He considered that this matter might be discussed in connection with item four on the agenda. Continuing, he said that while referring to the subject of the control of the black beetle of coconuts he would like to inform the meeting that in a few months the Government Agent, North-Western Province, and the Assistant Government Agent, Puttalam, had rendered every assistance possible through their Headmen, to further the campaign against this coconut pest. With their willing co-operation much had been achieved and the very satisfactory results obtained through their efforts was most encouraging. He considered that the members of the Board would wish to convey to the Government Agent, North-Western Province, to his Assistant at Puttalam, and to the Headmen of the Province, their thanks and appreciation of their work in connection with the control of the black beetle of coconuts.

Mr. C. Arulambalam enquired whether the Department of Agriculture had made any investigations on the suggestion he had made at the last meeting regarding the electro-magnetic treatment of fruit plants which had been carried out in India.

Mr. Rodrigo stated that Government intended to appoint a Horticultural Officer and that when this officer had been appointed he would be asked to investigate this question and his findings on it would be reported at a subsequent meeting of the Board. Mr. Arulambalam thanked the Director for his reply.

CHANGES IN MEMBERSHIP

His Excellency asked the Chairman of the Board to announce the changes in membership which had taken place since the last meeting.

Mr. E. Rodrigo announced the following changes :—

Mr. H. W. Ranatunga, nominated by the Anuradhapura District Agricultural Committee, had been appointed in place of Mr. L. L. Hunter who vacated his seat upon relinquishment of the office of Government Agent, North-Central Province.

Mr. L. L. Hunter had been appointed in place of Mr. James Forbes (Jr.), resigned.

Mr. S. F. H. Perera had been appointed in place of Mr. K. Balasingham.

Mr. Marcus S. Rockwood had been appointed in place of Mr. Leslie de Saram, resigned.

Gate Mudaliyar D. H. Kotalawala, M.S.C., renominated by the Uva District Agricultural Committee, had been re-appointed to the Board.

The Chairman then announced that there were three vacancies on the Executive Committee of the Board, nominations being necessary to fill the places of Gate Mudaliyar D. H. Kotalawala, Mr. James Forbes (Jr.), and Mr. K. Balasingham. The members of the Executive Committee were elected by the Board, but unless the meeting was anxious to fill these vacancies he suggested it might be preferable to allow them to remain unfilled since the life of the present Board terminated in May. It was agreed that this procedure be adopted.

FURTHER CONSIDERATION OF THE APPOINTMENT OF A COMMISSION OF ENQUIRY INTO PEASANT COLONIZATION SCHEMES

The Chairman pointed out that at the previous meeting it had been decided to refer this matter to the District Agricultural Committees for their consideration and views. This had been done and the memorandum which had been circulated to members of the Board indicated the general opinion of the District Committees. Fifteen out of the nineteen Committees had considered the suggestion that a Commission be appointed ; nine had indicated that they considered this would be too premature or that at this stage the

appointment of a Commission would not serve any useful purpose ; four had been in favour of the appointment of a Commission, and two had expressed more or less non-committal views. In the circumstances the Board should decide whether they await the views of the other four Committees or consider the matter further at that meeting.

His Excellency suggested that the Board should deal with the matter then and there. He said that when he first took part in agricultural operations, some fifty-five years ago, he was advised that it was unwise to dig up plants to see how they were progressing and he considered that the same principle applied very much to the Colonization Schemes at the present time. He would prefer to see them being allowed to develop for a while.

Mr. Wilmot A. Perera indicated that with due deference to the views of His Excellency he felt that this matter should be further considered and that if members would express their views he would endeavour to meet some of the arguments raised against the appointment of a Commission.

Mr. H. W. Amarasuriya opposed the appointment of a Commission since the Colonization Schemes were started comparatively recently and had not yet been given a sufficient trial. He suggested that since the Minister for Agriculture and Lands was there, the Board might seek his opinion which would be most valuable since these Colonization Schemes were his special interest. Mr. Amarasuriya thought it was premature to appoint a Commission and felt they should leave the matter in the hands of the Minister and his Executive Committee for Agriculture and Lands.

The Hon'ble Mr. D. S. Senanayake (Minister for Agriculture and Lands) said that although the resolution, requesting him to consider the advisability of appointing a Commission, left the matter to his discretion, he felt that if it were passed it would imply a desire on the part of the Board for a Commission to be appointed. That, he considered, would be merely putting off the matter and shelving an important question. If he had to recommend the appointment of a Commission, members of the Board would be nominated to serve on it as he did not think they had a more experienced body of agriculturists in Ceylon. If the members of the Board felt that some advice should be given to Government on the methods to be adopted on Colonization Schemes, he would prefer them to go into the matter and make definite proposals which he would be glad to place before his Executive Committee. While on this subject of colonization there were one or two points he would like to make very clear. There were several matters which had to be considered and which they were attempting to deal with in connection with Colonization Settlements, such as the question of village expansion, housing problems, etc. He stressed the difficulties the Colonists had to contend with and pointed out that the peasant himself could not be expected to do everything that would improve his lot on these settlements ; further it had to be remembered that the various problems differed from place to place. If a Commission were

appointed it would have to tour the whole Island and make proposals none of which might be applicable to all parts of the country. He felt it would be better than a Commission being appointed if members of the Board would take a personal interest in the subject ; they could then bring up all matters relating to Colonization Schemes for consideration by their District Committees or even to his notice. In that way they would be able to consider the special problems of their own districts ; they had representatives from the whole Island on the Board and if each representative would try to tackle the problem of his own district, the matter would be approached in a better way than by the appointment of a Commission.

Mr. Wilmot A. Perera intimated that the motion was not intended as a criticism of policy but that the idea of a Commission was in order to obtain an independent opinion of the problem as a whole, since large sums of money were being spent on Colonization Schemes. At the last meeting of the Kalutara District Agricultural Committee it was resolved that the Minister for Labour, Industry and Commerce might be requested to engage the investigators working on the economic survey to carry out an economic survey of these peasant settlements. If such a survey were carried out, he felt it would bring to light certain data which would reveal the actual state of affairs in the Colonization Schemes. After referring briefly to Sir Hugh Clifford's suggested land development scheme, Mr. Wilmot Perera indicated that he felt that Colonization Schemes dotted all over the country could not be made a success, but even if they were being worked successfully, he enquired whether it would not be advisable to consider if they could not be better developed. His main idea had been to obtain a detached point of view on the working of these Colonization Schemes.

His Excellency suggested that the motion might be withdrawn as the subject had been fully ventilated and it was clear that the Minister for Agriculture and Lands would prefer that the motion was not voted upon.

After further discussion His Excellency said that it was possible he had a greater knowledge of Commissions than most of those present at the meeting. The appointment of a Commission was sometimes an extremely convenient way of shelving a question with which one did not want to deal, but this was not the only object. Commissions were sometimes appointed with a view to finding out facts. In the case under consideration, any Commission appointed would take a considerable time to collect all the facts and circumstances connected with each individual Colony. At the end of that time they would have a body of Commissioners who even then would not be in possession of such detailed information as could be obtained easily by members of the Board in respect of individual Colonies. He thought, therefore, that the idea of centralisation by means of a Commission was not a sound one. If he were the Minister for Agriculture he would probably adopt much the same attitude as Mr. Senanayake had adopted and feel that the appointment of a Commission was a reflection on his Departments and more perhaps on

the Board of Agriculture. His Excellency therefore enquired whether Mr. Wilmot Perera was prepared to withdraw his motion.

Mr. Wilmot A. Perera then consented to withdraw the motion in view of what had been said on the subject.

THE CONTROL OF THE BLACK BEETLE AND RED WEEVIL PESTS OF COCONUTS

The Chairman stated that some notes and figures in this connection were being tabled and asked for any further observations or comments which members might desire to make.

Mr. Rolf Smerdon said that while thanking the various Revenue Officers for the particularly keen interest they had taken and the extraordinarily successful way in which they were treating this matter, he wished the Director of Agriculture to realise that they appreciated the part he had taken in it. They considered it was entirely owing to the action he had taken that anything at all had been done and they wished to congratulate him. Continuing, Mr. Rolf Smerdon said a very serious matter had now arisen in certain districts where both rubber and coconuts were grown. Apparently it was not generally understood that the coconut black beetle would breed in any refuse. On one estate where some old rubber had been felled it was found that the black beetle was breeding profusely in that area and the decaying rubber trees were riddled with black beetle in all its stages. In case there was difficulty in taking any action, he pointed out that regulations under the Plant Protection Ordinance stated that any organic material or anything that would be likely to act as a breeding place of the black beetle should be considered an offence. He considered the Department of Agriculture should broadcast this news to all rubber estates in coconut-growing areas, since some estates used felled rubber trees to buttress their terraces and naturally the black beetle could breed in these rubber logs. He felt the Board should use its influence to educate all planters interested in that matter and inform them that it was an offence against the Ordinance and deleterious to their own interests if they did not take proper care and attention to control the black beetle.

The Director of Agriculture accepted the suggestions made by Mr. Rolf Smerdon and said that in the absence of further observations he would regard them as a direction from the Board and take action accordingly. He hoped the planting community as a whole would learn of the direction given by the Board and respond to the suggestion that had been made. If the response was not satisfactory, he would bring up the matter before the Board again for consideration as to what future action should be taken.

CATTLE BRANDING

The President then informed the meeting that, as indicated on the agenda, it was suggested that the next two items, both of which referred to cattle branding, should be taken up for discussion together.

The two resolutions were as follows :—

(*a*) Moved by Mr. Rolf Smerdon on behalf of the Executive Committee of the Central Board of Agriculture :—

> "That the Central Board of Agriculture desires to record its appreciation of the fact that communal branding has been abolished by Government, and would now go further and recommend that private branding be also abolished, or, if that is not feasible, be restricted to the thigh and shoulder."

(*b*) Moved by Mr. S. M. K. B. Madukande, Dissawe :—

> "That this Board recommends to Government to frame and enforce early, rules compelling cattle owners to register at the local Kachcheries the brands they desire to put on their cattle in order to regulate private branding and to facilitate the identification of village cattle."

His Excellency then called upon Mr. Rolf Smerdon to speak on the resolution he was proposing.

Mr. Rolf Smerdon said he had the privilege of bringing forward resolution (*a*), as a member of both the Animal Husbandry Advisory Committee and the Executive Committee of the Central Board. That resolution had been passed unanimously by both of these Committees and embodied a principle on which the majority of members felt very strongly. His remarks on the subject of unrestricted branding were based, he said, on personal observations made on tours in different parts of the Island, and some of the sights one saw were really shocking. The extraordinary manner and art with which branding was practised had been carried to such extremes that any question of identification would become almost impossible in some cases. He referred particularly to medicinal branding in which peculiar marks were branded. He said he had seen one such case the previous month and he had been surprised at the number of brand marks in the form of twists, scrawls and corkscrews on the unfortunate animal. He had been amazed at the sight because the majority of the inhabitants at that place professed a religion, one of the main tenets of which was kindness. That method of branding, besides being painful, eliminated the commercial aspect of cattle as Ceylon hides were thin and tough compared with the thick hides of European cattle. In many cases the value of Ceylon hides was entirely lost owing to the disfigurement and terrible damage caused by unlimited branding.

Government had to be congratulated on having set an example by abolishing communal branding. The Animal Husbandry Committee would like to see branding abolished, but they realised the time had hardly arrived yet, nor was it feasible to carry it out. They thought, therefore, that the only way of setting the matter was to obtain a higher standard of organization and see that brand marks, when necessary, were restricted to the thigh and

shoulder. These parts of the hide were known in the trade as the "*butt*" and no very serious importance was given to any damage caused on those parts. He considered that branding was not the simplest form of marking animals for purposes of identification. If owners took a lively interest in animal husbandry and in the care of their cattle, they could organise themselves to stop the inhuman cruelty necessitated by cattle branding and they would then reap the benefits that would accrue to them in the quality of the hides of their cattle. In concluding Mr. Rolf Smerdon asked the members of the Board to add that the resolution was being forwarded to Government with the hope that their considered opinion would be implemented at an early date. He added that many of his remarks would be found in Department of Agriculture Leaflet No. 97, copies of which were tabled.

Mr. Wace de Niese seconded the resolution of Mr. Rolf Smerdon and referred to the early history of the agitation to stop cattle branding in Ceylon. Some years ago a resolution was forwarded to Government requesting that there should be a total abolition of cattle branding. That resolution had been referred to the Police who had reported against it since there would be no means of identifying stolen cattle. Against this view it had been suggested that cattle lifting was not done for the purpose of sale but for immediate slaughter. It had been suggested also that Ceylon cattle were not bred for the purpose of beef or for the sale of the hide, but for the purpose of agricultural work and the supply of milk. He contended that if cattle were branded in the manner advocated it would be greatly to the benefit of all.

Mr. Madukande stated that he opposed the first motion on account of the conditions which prevailed in the dry zone of the Island. Last October, Government had repealed all rules and regulations regarding cattle branding, and it was now optional, being left to the cattle owners whether they branded their animals or not. The first motion aimed at prohibiting private branding and making it an offence, but enough harm had been done already to cattle owners in the dry zone by abolishing communal branding and the issue of vouchers for their sale or transfer. In 1935, when a motion recommending the abolition of cattle branding and cattle vouchers was considered by the Board, he had opposed it. He had pointed out the difficulties of the dry zone villagers who, owing to shortage of pasture, etc., were compelled to allow their cattle to graze in fields, tank beds, and other places where there was some pasturage. This resulted in the mixing together of all the village cattle and branding was necessary for purposes of identification. He had suggested that perhaps the abolition of branding could be adopted in districts where local conditions would permit it and that before any decision was arrived at, the District Agricultural Committees should be consulted. Soon after this he had brought up the matter at a meeting of the Vavuniya District Agricultural Committee, the members of which had been unanimous that it was not desirable to abolish cattle branding in that district. In spite of this, Government had repealed the rules and regulations regarding cattle

branding all over the Island and had intimated that all transactions in cattle should be conducted on the same lines as other movable property. This practically meant that the person in whose custody cattle were found was the virtual owner and no further proof of ownership was necessary. Under these conditions, if villagers wanted to keep cattle they must adopt one or other of three methods, *viz.* :—(1) they must stall-feed all their cattle, (2) keep them confined in well fenced enclosures of considerable extent, such as coconut or rubber estates, or (3) employ cattle keepers to drive their cattle to pasture during the day and get them all together into kraals (*Kotuwa*) at night and watch them. These three methods, he contended, were not practicable in the dry zone ; by cattle he meant neat cattle which included buffaloes. He admitted that villagers were lax in looking after their neat cattle and that many of them owned more than they could look after because they did not derive much benefit from them. They did not generally use cow milk as they preferred buffalo milk and there was no sale for their cow milk. There was very little demand for neat cattle as traders did not buy them for slaughter and there was no market for them, though a few of the bulls were trained for draught purposes. If ways and means could be found to dispose of these cattle in proportion to their increase, the villagers would be benefited and were sure to look after them properly. In the case of buffaloes, continued Mr. Madukande, matters were different ; they were mainly used for paddy cultivation in the dry zone areas and extensive use of them was made by villagers for their milk and ghee. There was also a great demand for buffaloes for slaughter which he considered should be stopped so that they could maintain a good supply of buffaloes for agricultural purposes. Buffaloes could not be stall-fed as they were in the habit of wandering about looking for pasture in the jungles ; as a result of their roaming from village to village they became mixed and it was very desirable, therefore, that they be both privately and communally branded. It appeared to him that the main objection against the branding of cattle was that the damage to the hides caused them to lose their market value. In the dry zone the cattle owners were not interested in the hide trade as they were not directly benefited by it. The hardships cattle owners would suffer from the abolition of branding would be much greater than the losses caused by branding. With regard to the proposal to restrict branding to the thigh and shoulder, he submitted that it was not always practicable and if enforced would lead to numerous prosecutions. Inexperienced villagers could not be expected to brand Sinhalese and Tamil letters with their flourishes within the limited space of the thigh and shoulder. He recommended that all cattle owners should be made to adopt a definite form of brand for their cattle, either in the form of a design or a few letters, and that they should get their brands registered at the local Kachcheri. A register could be maintained in the Kachcheri for purposes of reference to settle disputes of ownership. He considered that such a proposal would enable the Government Agents to regulate the form of brands used.

Mr. S. Armstrong supported the motion of Mr. Madukande and from his own experience he considered some form of branding was necessary. He agreed with the last sentence of the first motion that branding should be restricted to the thigh and shoulder and thought that form should satisfy all cattle owners.

The Director of Agriculture said he would like to explain to the Board the views of the Department on branding and he thought it might be possible to adopt some sort of compromise in that matter. The Department sympathised with both motions and recognized the economic disadvantage and the inhumanity of the artistic exuberance of the brander. It also recognized the difficulties which cattle owners had with regard to looking after their cattle. Cattle branding was a traditional practice of past ages and it could be considered a serious interference with one's personal liberty, and right not to be allowed to dispose of one's property as one liked. In the circumstances he suggested that he be allowed to initiate and pursue the policy of action recommended in Departmental Leaflet No. 97. He would thereafter make it his object to reduce cattle branding to the minimum possible and consistent with what was considered necessary for village requirements. He would start a campaign to teach the villagers how cattle branding could be carried out without inflicting much cruelty and, side by side with this, he would pursue a policy of teaching people how to stall-feed their cattle by means of fodder grasses. He suggested that the proposals in both the motions should be withdrawn so as to allow him to pursue that policy for one year. If at the end of that period it was found that the results achieved were not adequate, the matter could be reopened.

Mr. Rolf Smerdon said that with the permission of His Excellency and with that of the Director of Agriculture as Chairman of the Executive Committee he would withdraw his motion.

After some further discussion, His Excellency the Governor stated that the general feeling of the meeting appeared to be that the matter might be safely left in the hands of the Director of Agriculture and enquired whether Mr. Madukande would agree to withdraw his motion.

Mr. Madukande, Dissawe, thereupon withdrew his motion and the discussion was closed.

SOIL EROSION

His Excellency the Governor stated that it was considered that the next two items on the agenda, both of which related to the subject of soil erosion, could be discussed together if the meeting so wished.

The first of these items was the further consideration of the provision of a whole-time officer for work and propaganda in connection with the prevention of soil erosion on which a resolution had been passed at the previous meeting of the Board, and concerning the sequel to which, papers had been circulated to all members.

The second item on this subject was to consider the following resolution moved by Mudaliyar N. Wickremaratne :—

> " That this Board considers that further investigation into preventive and remedial measures of soil erosion in tea, rubber and coconuts falls within the province of the Tea, Rubber and Coconut Research Schemes respectively and that these bodies should be requested to formulate definite measures and advise planters to adopt them."

Mr. R. P. Gaddum enquired whether this resolution implied the amendment of the resolution unanimously adopted by the Board at its last meeting.

Mudaliyar Wickremaratne repudiated the claim that the former resolution to which Mr. Gaddum had referred had been unanimously adopted. He pointed out that on receipt of the papers circulated in this connection, he had written to the Secretary and pointed out that he had not voted in favour of the resolution. With regard to the resolution he had proposed, he said there would appear to be no justification for the existence of the various research institutes unless their principal activities were concerned with the conservation of the soil. As these research schemes were partly financed by Government, he considered it only fair and equitable that each of the Institutes should depute one of its officers to deal with the problem of soil erosion.

Mr. Madukande, Dissawe, seconded the resolution.

Colonel T. Y. Wright suggested that the Board would be pleased to hear the views of the Hon'ble the Minister for Agriculture and Lands before the subject was debated further.

The Hon'ble Mr. D. S. Senanayake said he felt that the prevention of soil erosion was among the most important matters to be undertaken in the Island and was not a problem which could be taken up by one section of the population but needed the co-operation of others, including the Government. At the same time he did not see what advantage was to be gained by appointing a single officer, for apart from the cost to Government of his travelling all over the Island, it would be difficult to gauge the widely divergent view held by agriculturists on this subject. He said the problem was a vast one involving far-reaching changes ; investigation was necessary into its relation to the type of cultivation concerned, the obligation of Government Departments, the responsibility of village cultivators and of planters. He enquired what one officer could do. An examination of the various proposals in the Report of the Soil Erosion Committee would indicate that their success was based on co-operative action.

Mr. Gaddum said he was glad to hear what the Hon'ble the Minister had said as it would give him an opportunity for stating the reasons which led to the framing of the resolution adopted at the last meeting. He said that the Hon'ble the Minister, while being sympathetic with the resolution

regarding the appointment of a whole-time soil erosion officer, appeared to consider the problem so complex and so profound that he did not consider one officer was likely to achieve any useful results. The reasons which had led to that view were perhaps to be found in the draft programme of work for which a soil erosion officer was required and Mr. Gaddum admitted that almost any one of the sections in that programme was, in itself, more than sufficient to occupy the energies of a whole-time officer. From that aspect alone it was perhaps thought that the recommendation of the Board was hasty and ill-conceived, but before that conclusion was accepted it would be well to examine in outline the events which had led to its adoption by a body which represented every type of product grown and every phase of agricultural activity which existed in Ceylon at the present time.

Consideration of the importance of soil erosion and its deplorable results, said Mr. Gaddum, was not a mushroom growth on which public attention had only just been focussed. It dated back to 1878, nearly sixty years ago, and they were still flirting with the idea of appointing a special officer to examine that vital problem. Various reports and papers had drawn public attention to the increasing evil, but although these attracted a certain amount of notice, no attempt had been made to examine the subject with any degree of continuity. The report of the Soil Erosion Committee, published in 1931, merely emphasised the need for definite action, but the general depression that was then being experienced made it impossible either for Government or the major planting industries to give those recommendations the attention they merited. Later in the same year as a result of the proposals which had been put forward by the late Mr. C. E. A. Dias, they were led to understand that the services of a Government Officer would be available for anti-soil erosion propaganda purposes, while in 1932 it had been suggested by the Board that the recommendations in chapter five of the report of the Soil Erosion Committee should engage the attention of the Ministry of Agriculture, particularly with regard to checking erosion on small holdings in tea. In 1934 and 1935 the problem had been further discussed and a questionnaire on soil erosion in general and weeding in particular, brought forward the suggestion last year that legislation should be enforced to stop the use of "scrapers." They were all aware that the suggested legislation had been considered impracticable and for that reason had not been adopted by the Board, but its impracticability had made the Board realise their lack of knowledge and the necessity for the appointment of an officer who would view the various problems from one single aspect. The object of having a whole-time officer was to have all the information on the subject collected for submission to the Board and he did not consider the Board would be in a position to formulate any concrete proposals until such time as an officer had been appointed. In conclusion he emphasised the fact that whatever progress were made with regard to their knowledge of tea, rubber, coconuts and other products, such knowledge

must be regarded as superficial when compared with the knowledge of how to preserve the soil in which they grew these crops.

Colonel T. Y. Wright doubted whether any one officer in the service of Government or of the Research Schemes could be found who was capable of fulfilling all the responsibilities implied in the resolution. He suggested instead that there should be four officers, one seconded from each of the three Research Institutes and one from Government. It was essential, he said, that these officers should be seconded and not be new appointments in view of the large increase in personal emoluments and pensions during the last few years.

Dr. C. H. Gadd (Acting Director, Tea Research Institute), said the motion moved by Mudaliyar Wickremaratne fell naturally into two parts. The first was a statement that further investigation into preventive and remedial measures of soil erosion in tea, rubber and coconuts fell within the province of the Tea, Rubber and Coconut Research Schemes, respectively. That was true so far as it went but he enquired whether the Board had just cause to issue a reminder to the Research Schemes of that fact. When the Board last discussed the subject of soil erosion, he found in the minutes, so far as the Tea Research Institute were concerned, that both Dr. Norris, their Director, and Dr. Eden, their Agricultural Chemist, had spoken at length. Their remarks had dealt mainly with some of the lines of investigation occupying the attention of the Institute, and appeared to have been of sufficient importance as to merit their having occupied a considerable amount of space in the report of the proceedings. In further evidence of their activities in soil erosion investigations, he would refer them to the publications of the Tea Research Institute in which they would find the subject adequately dealt with. If he might make one particular reference to soil erosion research, he would refer them to a series of articles in the "Tea Quarterly" for 1933 by Dr. Eden. Those articles were a somewhat popularised version of a more technical paper which Dr. Eden wrote for, and was published by, the Imperial Bureau of Soil Science. Much of that work had been done while the author of it was on home leave. He submitted that a study of the evidence would prove conclusively that the Tea Research Institute and the other Research Schemes had not ignored the investigation of preventive and remedial measures of soil erosion on tea, rubber and coconut lands. The improvement of cultural methods for tea was so linked up with soil erosion prevention that it was impossible to do much concerning the former without keeping the latter in mind.

Referring to the second part of the resolution, which was a request that the Research Schemes would formulate definite measures for the prevention of soil erosion and advise planters to adopt them, Dr. Gadd said he hoped it would not come as a great surprise to many to learn that advisory work on soil erosion preventive measures was routine work of the Research Schemes.

It was impossible to carry out that advisory work without having decided previously the principles it was intended to apply. A review of the principles they applied to tea had been published as recently as last December in the "Tea Quarterly." Further, their advisory work was not restricted to planters as they had two whole-time officers working in the villages instructing small holders, and he considered he could claim that very effective work was being done. The motion therefore appeared to be a request that the Research Schemes should be asked to do something which they had been doing for years to the best of their ability. He hoped that the Board would vote solidly against the motion.

Continuing, Dr. Gadd said it was implied in the motion that soil erosion investigations and advisory work were matters for the attention of the Research Schemes only. He considered soil erosion should be a matter of concern to every body or society, political or otherwise, which had at heart the conservation of the natural wealth of Ceylon. The wealth of Ceylon could be defined in two words—*soil fertility ;* a Ministry which had the land of Ceylon in its charge automatically had the guardianship of her wealth. Soil fertility, he said, could be depleted in two ways. Soils protected against erosion might decline steadily in their supply of plant food as a result of improper cropping, but in that case the physical body of the soil remained and the plant nutrients could be restored by the proper use of fertilisers. On the other hand soil stripped bodily from the fields by wind, rain or the misuse of agricultural implements was lost, usually for ever. The first type of soil depletion might make agriculture temporarily unprofitable ; but the second type, namely erosion, could make farming permanently impossible. Practical measures of erosion control could be classified under several main heads, two of the most important being, (1) the adaptation of close growing vegetation to agricultural operations, and (2) the use of engineering structures, such as terraces and drains. It was unwise, however, to rely on any single method of preventing erosion ; all available methods had to be welded together to form a composite programme and adjustments made to meet the special requirements of different crops on different types of land, as determined by soil, slope and rainfall.

Dr. Gadd went on to state that the enormity of the work had already been indicated, and its wide range and the number of subjects it covered were admitted. If, however, a whole-time officer would be unable to achieve any useful result, he enquired what could be expected from the efforts of part-time officers. Neither the Research Schemes nor, probably, the Department of Agriculture had sufficient staff to allocate the whole-time of one officer to soil conservation problems, yet their efforts had not been without result. How much more could be achieved, if, in addition to those part-time officers who had multitudinous other duties to attend to, there was an officer who devoted his whole time to the subject. The office of such an officer could

become the clearing-house for information and he would be able to devote time to some of the work which was outside the scope of the Research Schemes. Quoting one example, he said soil erosion was no respecter of persons and it was certainly not restricted to larger estates ; some of the worst examples of erosion were to be seen in village lands. Amongst these were tea small holdings, with which he was more intimately acquainted and there one would find holdings of one or two acres with no natural drainage feature. In those places the owners were confronted with problems not met with on larger estates, one of which was how were they to dispose of their excess drainage water. The holdings might be surrounded by other undrained agricultural land, or they might slope towards a paddy field or *Gansabawa* (Village Committee) road. The villager was as desirous as others of living in peace with his neighbours and had no desire to risk prosecution for damage to paddy lands or roads. Efficient drainage was one of the most important soil erosion measures, yet what could the villager do about it. In the Gampola area were to be seen some excellent drainage works in the tea small holdings, in some of which, in order to save their soil, the owners had constructed extensive systems of silt pits. That work would have been much more efficient had there been some outlet for excess water. He said he did not know which Government department was responsible for agricultural drainage schemes, but he did feel that a soil conservation officer would have to take up that problem early.

The Hon'ble Mr. D. S. Senanayake said he had not realised that the object of the resolution had been to employ an officer to collect information and they should appreciate the fact that an officer employed for that purpose would not be required for very long. It was quite possible that they would need a complete staff to take up the problem ; the officers of the Department of Agriculture were hard worked men and he could not visualize their being burdened with the task of collecting the desired information. The question of soil erosion was not a matter they were taking up on behalf of the planting community alone ; in his opinion they required the least assistance since they of all communities were most conscious of the evil of erosion. Any measures that were contemplated would necessarily be concentrated among those who most needed to be instructed on the seriousness of the subject.

Mr. T. E. H. O'Brien (Director, Rubber Research Scheme), endorsed the remarks made by Dr. Gadd and referred to the work being carried out on soil erosion problems connected with the rubber industry.

Dr. R. Child (Director, Coconut Research Scheme), said he agreed with the remarks made by Dr. Gadd and Mr. O'Brien and pointed out that the Coconut Research Scheme was a small one with a staff of only three executive officers.

After further discussion Mr. R. P. Gaddum proposed and Mr. R. G. Coombe seconded the following amendment to the motion proposed by Mudaliyar N. Wickremaratne :—

> " That this Board requests the Hon'ble the Minister for Agriculture and Lands to re-consider the resolution on the subject of soil erosion which was passed at the last meeting of the Central Board of Agriculture."

This motion was accepted by the Board put to the meeting as a substantive resolution and passed.

Mudaliyar Wickremaratne withdrew his resolution, stating that he was content to leave the matter in the hands of the Hon'ble the Minister for Agriculture and Lands.

The Hon'ble Mr. D. S. Senanayake stated that he proposed to suggest to his Executive Committee that Government be asked to second a Civil Servant for that work so that he might obtain the information from the different Institutes and other bodies to be placed before the Board for them to advise on the steps to be taken and formulate definite proposals. The discussion on this subject then closed.

His Excellency the Governor then vacated the Chair, intimating that he had to leave the meeting at this juncture as he could not spare the time to continue presiding.

The Director of Agriculture then took the Chair and enquired whether the Board desired to proceed with the remainder of the agenda since the time was already late.

Mr. R. P. Gaddum proposed that the Board should adjourn. This proposal was put to the meeting and carried. The Board then adjourned *sine die* at 12·40 p.m.

W. C. LESTER-SMITH,
Acting Secretary,
Central Board of Agriculture

MINUTES OF A MEETING OF THE BOARD OF THE TEA RESEARCH INSTITUTE OF CEYLON HELD AT THE CEYLON CHAMBER OF COMMERCE, COLOMBO, ON WEDNESDAY, APRIL 7TH, 1937, AT 11 A.M.

Present.—Mr. R. G. Coombe (Acting Chairman), The Acting Financial Secretary (Mr. C. H. Collins), The Director of Agriculture (Mr. E. Rodrigo), The Chairman, Planters' Association of Ceylon (Mr. R. P. Gaddum), The Chairman, C. E. P. A. (Mr. C. E. Hawes), Major J. W. Oldfield, C.M.G., O.B.E., M.C., Messrs Gordon Pyper, J. D. Hoare, W. H. Attfield, T. B. Panabokke, Col. T. G. Jayawardene and Dr. C. H. Gadd (Acting Secretary and Director).

Absent.—Mr. D. T. Richards.

The Notice calling the Meeting was read.

The Chairman, on behalf of the Board, expressed deep sympathy at the loss sustained by Mr. D. T. Richards in the death of his wife.

A vote of condolence was passed in silence.

MINUTES

The Minutes of the Meeting of the Board held on December 19th, 1936, were confirmed.

Reported that the seal of the Board was affixed to an agreement between K. Saineris Silva and the Board, re the lease of St. Coombs Caddy in the presence of Messrs R. G. Coombe, R. P. Gaddum and the Director.

Reported that the charge for full page advertisements in the Tea Quarterly had been raised from Rs. 25·00 to Rs. 30·00 and for the half page from Rs. 15·00 to Rs. 20·00.

MEMBERSHIP OF THE BOARD

The Chairman reported that (*a*) H. E. the Governor had been pleased to appoint Mr. T. B. Panabokke to represent the Small Holders on the Board, vice Mr. D. H. Kotalawala, resigned. (*b*) The General Committee of the Planters' Association of Ceylon had nominated Mr. Gordon Pyper to act for Mr. James Forbes (Jnr.) in place of Mr. A. G. D. Bagot who had resigned. (*c*) The Ceylon Estates Proprietary Association had nominated Mr. W. H. Attfield to act for Mr. I. L. Cameron during his absence on leave.

FINANCE

(*a*) Auditors' report and accounts for 1936.

(1) *Report on T. R. I. Accounts.*—The Acting Secretary said that the Hon'ble the Financial Secretary had raised two questions

concerning (1) the creation of an Obsolescence Reserve and (2) the suggested change in the method of calculating Depreciation.

The Finance Sub-Committee recommended that (1) The consideration of the creation of an Obsolescence Reserve should be deferred until the Auditors' comments on the Financial Secretary's letter were received, and until the return of the permanent Chairman. (2) No change should be made in the method of calculating Depreciation.

(2) *Report on Estate Accounts.*—The Acting Secretary briefly summarised the views of the Finance Sub-Committee which recommended that (*a*) The Superintendent should be instructed to improve the method of accounting along the lines suggested by the Auditors. (*b*) The Superintendent should be instructed to issue a short report indicating what recommendations of the Auditors are being put into effect, and what recommendations (if any) are offering difficulty. It was decided to adopt the above recommendations of the Finance Sub-Committee on the Auditors' Reports.

The audited accounts as at December 31st, 1936, were adopted.

(*b*) *Statement of Accounts at 28th February,* 1937, were adopted without comment.

(*c*) *Supplementary Estimates.*—The Chairman stated that the Finance Sub-Committee had carefully considered the estimates submitted by the Acting Director and recommended their approval. Approved.

A revised forecast of receipts and expenditure incorporating the Finance Sub-Committee's recommendations was tabled.

(*d*) *E. C. P. Drier.*—The Chairman reported that by circulation of papers (A. 6/37 of March 8th, 1937), unanimous approval had been given to an expenditure of Rs. 9,630·00 for a 3-foot E. C. P. Drier.

(*e*) *Investments.*—It was decided to adopt the Finance Sub-Committee's recommendation, and to authorise the Acting Director to apply for Rs. 30,000·00 of the new Ceylon Local Loan.

(*f*) *Estimates for Bungalows.*—The Chairman was authorised to make a final decision between the estimates of Messrs Braid & Co. and Messrs M. Y. Hemachandra & Co.

(*g*) *Sale of Shafting.*—The Director was empowered to sell the shafting above the experimental rollers should opportunity occur as recommended by the Finance Sub-Committee.

VISITING AGENT

The Visiting Agent's report of his visit of February 23rd, 1937 was accepted without comment.

On the proposal of the Acting Chairman, seconded by Mr. C. E. Hawes, it was decided to offer the appointment as Visiting Agent to the Institute to Mr. H. Tonks of Delmar, Halgranoya.

EXPERIMENTAL AND ESTATE SUB-COMMITTEE

The Minutes of the Experimental and Estate Sub-Committee meeting of March 20th, 1937, were accepted without comment.

CONFERENCE

The Chairman reported that a very successful Conference was held at St. Coombs on January 22nd and 23rd, 1937.

The Chairman read the following letter which he had received from the Chairman of the Centrale Vereeniging Tot Beheer van Proefstation, Voor de Overjarige Cultures in Nederlandsch-Indie, Batavia, dated March 18th, 1937 :—

" Dear Sir,

On behalf of the tea planters, members of our organisation, I wish to express my cordial thanks to you and all the gentlemen who have contributed to the most kind reception accorded to Dr. Th. G. E. Hoedt, Director of the Proefstation, West Java, and Mr. J. C. A. Bosschieter during their recent sojourn in Ceylon.

I am most indebted to you, to the Director and to the staff of St. Coombs for the assistance and friendship given to my countrymen.

I assure you that the Netherlands Indian tea planters set great value on a close co-operation with your tea industry and they will be very glad to reciprocate your hospitality in case of a visit of one of your Ceylon tea experts to this country.

Yours faithfully,
(Signed) .....,
Chairman."

SENIOR SCIENTIFIC STAFF

The Chairman reported that (*a*) The Director departed on leave on February 16th, 1937, and that the Mycologist had acted for him from that date. (*b*) The Mycologist had been placed on the Selection Grade as from January 1st, 1937. (*c*) The Tea Technologist had been placed on the salary scale of £720 per annum as from the 12th February, 1937. (*d*) An increment of Rs. 50·00 per annum fell due to the Plant Physiologist as from 1st February, 1937. The Board approved the increment.

JUNIOR SCIENTIFIC STAFF

(*a*) *Dr. J. G. Shrikhande.*—It was decided to grant Dr. Shrikhande a further period of four months' sick leave without pay dating from March 1st, 1937.

(*b*) *Mr. E. F. Kannangara.*—The Board approved an increment of Rs. 20·00 per mensem due to this officer as from March 1st, 1937.

VISITORS

The Acting Director reported that Dr. Wellensiek of the D. E. Indies Research Station proposed to visit the Institute at the end of April. The Board welcomed the proposal and authorised the Acting Director to make all necessary arrangements.

ANY OTHER BUSINESS

Coronation of H. M. King George VI.—Circular No. 26 of the Ceylon Estates Proprietary Association was read and it was agreed that the Institute should follow the recommendations therein for celebrating this event.

The meeting terminated with votes of thanks to the Chamber of Commerce for the use of the room, and to the Chairman for officiating.

C. H. GADD,
Acting Secretary.

CENTRAL SEED STORE

It is hereby notified for general information that the Central Seed Store, Peradeniya, maintained by the Department of Agriculture has been temporarily closed until more satisfactory arrangements have been made to enable the Department to guarantee the quality of the seed that is sold.

Departmental seed stations are being established for raising selected varieties of all kinds of local vegetables, and it is expected to be able to issue selected and proved seed to the public in about 2 years, when the seed store will be re-opened.

ANIMAL DISEASE RETURN FOR THE MONTH ENDED APRIL, 1937

Province, &c.	Disease	No. of Cases up to date since Jan. 1st, 1937	Fresh Cases	Recoveries	Deaths	Balance Ill	No. Shot
Western	Rinderpest	..	..	..	..	..	..
	Foot-and-mouth disease	70	17	66	..	4	..
	Anthrax	..	..	..	..	..	..
	Rabies	6	2	..	..	..	6
Colombo Municipality	Rinderpest	..	..	..	..	..	..
	Foot-and-mouth disease	430	92	403	7	20	..
	Anthrax	7	..	..	7	..	..
	Rabies	10	3	..	10*	..	..
	Blackquarter	1	1	..	1		
Cattle Quarantine Station	Rinderpest	..	..	..	..	..	..
	Foot-and-mouth disease	1	..	1	..	..	..
	Anthrax	16	7	..	16	..	..
Central	Rinderpest	..	..	..	..	..	..
	Foot-and-mouth disease	68	4	63	1	4	..
	Anthrax	..	..	..	..	..	..
	Piroplasmosis	1	..	..	1	..	..
Southern	Rinderpest	..	..	..	..	..	..
	Foot-and-mouth disease	..	..	..	..	..	..
	Anthrax	..	..	..	..	..	..
Northern	Rinderpest	..	..	..	..	..	..
	Foot-and-mouth disease	1093	235	1008	30	55	..
	Anthrax	..	..	..	..	..	..
Eastern	Rinderpest	..	..	..	..	..	..
	Foot-and-mouth disease	61	..	61	..	..	..
	Anthrax	..	..	..	..	..	..
North-Western	Rinderpest	..	..	..	..	..	..
	Foot-and-mouth disease	2	..	2	..	..	..
	Anthrax	..	..	..	..	..	..
	Rabies	3	1	..	1	..	2
North-Central	Rinderpest	..	..	..	..	..	..
	Foot-and-mouth disease	39	17	27	..	12	..
	Anthrax	..	..	..	..	..	..
Uva	Rinderpest	..	..	..	..	..	..
	Foot-and-mouth disease	131	..	125	6	..	..
	Anthrax	..	..	..	..	..	..
	Rabies	2	..	..	..	..	2
Sabaragamuwa	Rinderpest	..	..	..	..	..	..
	Foot-and-mouth disease	..	..	..	..	..	..
	Anthrax	..	..	..	..	..	..
	Piroplasmosis	4	..	3	1	..	..

*All destroyed.

Department of Agriculture,
Peradeniya, 19th May, 1937

M. WIJAYANAYAKA,
Acting Government Veterinary Surgeon.

METEOROLOGICAL REPORT—APRIL, 1937

Station	Temperature: Mean Maximum	Temperature: Difference from Average	Temperature: Mean Minimum	Temperature: Difference from Average	Humidity: Day	Humidity: Night (from Minimum)	Amount of Cloud	Rainfall: Amount	Rainfall: No. of Rainy Days	Rainfall: Difference from Average
	°	°	°	°	%	%		Ins.		Ins.
Colombo ..	87·1	−0·7	75·7	−0·2	76	91	7·5	10·64	18	+ 1·76
Puttalam ..	89·2	0	76·1	+0·1	74	91	5·5	6·47	12	+ 1·58
Mannar ..	90·0	−1·0	78·4	+0·5	72	86	5·8	4·44	10	+ 1·31
Jaffna ..	89·6	+0·2	79·1	−0·9	72	85	7·0	5·21	8	+ 3·72
Trincomalee ..	89·0	−0·1	78·3	+0·7	72	82	5·8	3·42	11	+ 1·43
Batticaloa ..	86·9	−1·0	77·2	+0·7	78	91	5·7	5·94	5	+ 4·19
Hambantota ..	88·2	+0·6	76·2	+0·1	75	91	5·3	2·92	13	− 0·39
Galle ..	86·5	+0·3	76·8	+0·2	76	86	6·2	10·75	18	+ 1·97
Ratnapura ..	90·0	−1·4	73·9	+0·2	76	93	6·4	12·68	22	+ 1·44
Anuradhapura ..	90·6	−0·8	74·6	−0·2	72	95	7·0	3·32	9	− 2·54
Kurunegala ..	90·3	−0·9	74·5	−0·1	70	90	5·8	9·40	17	− 0·05
Kandy ..	88·4	+0·6	70·3	+0·5	69	90	5·2	2·86	10	− 3·37
Badulla ..	82·6	−1·6	66·8	+0·8	70	92	5·6	10·13	15	+ 3·71
Diyatalawa ..	75·6	−2·4	60·7	+0·9	74	91	4·4	8·56	17	+ 3·32
Hakgala ..	72·7	−2·1	56·3	+2·3	76	88	5·8	5·59	16	− 1·55
Nuwara Eliya ..	71·3	−0·2	52·0	+3·5	79	88	7·8	4·39	18	− 0·27

The rainfall in April was on the whole below normal. There was appreciable excess in the districts just south of Batticaloa, and on or near the south-west coast, while other stations near the coast generally showed some excess. Inland and among the hills the rainfall was generally in deficit. The highest monthly total was 24·05 inches, at St. Leonard's estate, and monthly totals of over 20 inches were also recorded at Batapola, Pimbura, Dartonfield, Geekiyanakanda and Kanana estates.

13 daily falls of at least 5 inches were reported, nearly all for the 25th. The highest was 7·50 inches, at Baddegama, on the 25th.

Weather conditions at the beginning of April were of the intermonsoon type, with weak barometric gradients and local afternoon and evening thunderstorms. From the 9th, weather conditions became slightly unsettled, and the rainfall increased. On the 13th weather conditions improved, but on the 15th a depression was reported in the Bay of Bengal, and the rainfall over Ceylon again increased. Weather conditions became more settled on the 18th, and very little rain was reported till the 24th. The barometric gradients now became more south-westerly, and moderate rain was fairly widespread at first, but by the end of the month showed a tendency to concentrate in the south-west and the hills.

Temperatures in the low country showed, on the whole, no appreciable deviation from normal. Up-country stations, however, were generally below their average by day, and above by night, giving an appreciably lower diurnal range than usual. Day humidities were generally above normal, and night humidities below normal. Cloud was in excess at nearly all stations. Barometric pressure was in deficit. Wind strength was above normal, while its direction was variable.

There was a hailstorm near Diyatalawa on the 25th.

H. JAMESON,

Supdt. Observatory.